Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

FEBRUARY, 1959

CONTENTS:

Composition and Application of Anodes
Types and Uses

Abrasive Sheets and Belts
Basic Factors in Their Selection

Evaluation of Paint Spray Booths
Comparison of Exhaust Systems

Sulfate Determination in Chromium Plating Solutions
Volumetric Method Using E.D.T.A.

Plating Waste Disposal
An Integrated System

Electroless Nickel Plating of Carbon
Proper Preparation of Surface

Science for the Coatings Technologist
Mildewcide Materials

Which Rectifier for Electroplating – Silicon or Germanium?
Factors Influencing Choice

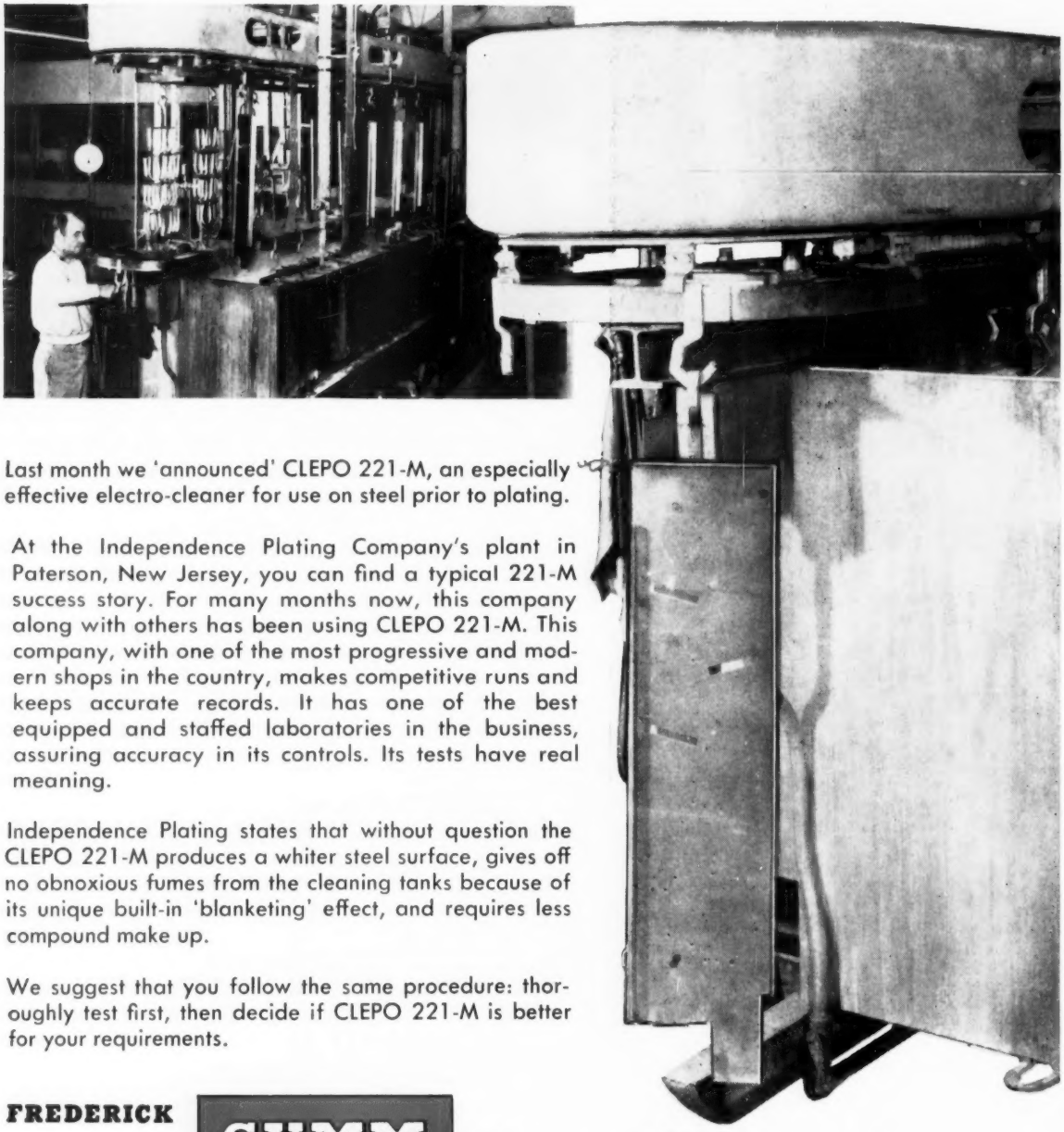
Science for Electroplaters
Amides

Complete Contents Page 45

Read and pass on –

A Typical *Success Story*

for CLEPO 221-M



Last month we 'announced' CLEPO 221-M, an especially effective electro-cleaner for use on steel prior to plating.

At the Independence Plating Company's plant in Paterson, New Jersey, you can find a typical 221-M success story. For many months now, this company along with others has been using CLEPO 221-M. This company, with one of the most progressive and modern shops in the country, makes competitive runs and keeps accurate records. It has one of the best equipped and staffed laboratories in the business, assuring accuracy in its controls. Its tests have real meaning.

Independence Plating states that without question the CLEPO 221-M produces a whiter steel surface, gives off no obnoxious fumes from the cleaning tanks because of its unique built-in 'blanketing' effect, and requires less compound make up.

We suggest that you follow the same procedure: thoroughly test first, then decide if CLEPO 221-M is better for your requirements.

FREDERICK GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

How to make rust-and-scale removal an exact science: For more than 20 years, Enthone has studied metal finishing problems and developed specialized solutions. Among the rust and scale removal compounds perfected by Enthone research and proved in the field, are the Alka-Deox® series of alkaline materials which electrolytically or non-electrolytically remove rust and scale from steel, cast or malleable iron; Enthol® 42, a solvent acid cleaner for steel, zinc, aluminum and other metals; and Actane® 70, a replacement for hydrofluoric acid as a dispersing agent in acid pickles to remove colloidal and siliceous films from metals. Write us about your special oxide removal problems. Chances are we have the answer in stock. Enthone, Inc., 442 Elm Street, New Haven 11, Connecticut.

ENTHONE

ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

50 *years of results that satisfy just about everybody... except Oakite.* And we never will be satisfied. Our goal has always been to furnish even *better* cleaning at even *lower* cost—AND IT ALWAYS WILL BE!

Sure we're proud of the hundreds of Oakite "firsts" in developing fine cleaning compounds, cost-cutting methods, time-saving mechanical equipment. But we'll never rest on pride. As soon as we find a satisfactory answer to a cleaning problem—our research starts searching for an even better one.

That's why so many users continue to rely on Oakite to reduce their "per unit" cost. They know that year after year, they are getting the best cleaning for the lowest possible cost.

OAKITE®
50 1909-1959 SCIENCE
years' leadership in industrial cleaning

Oakite's pioneering in the future will mean what it has meant for the past 50 years: not only better products, but better service . . . better methods . . . better equipment. All deliberately designed with you in mind to give *you* the most for your cleaning dollar.

This handy guide is a distillation of 50 years of Oakite cleaning experience. It can save you valuable time—and cold cash, too—on all your cleaning operations. Send for it. Oakite Products Inc., 50A Rector Street, New York 6, N. Y.

METAL FINISHING is published monthly by Metals and Plastics Publications, Inc., 381 Broadway, Westwood, N. J., U.S.A.
SECOND CLASS POSTAGE PAID at the Post Office in Westwood, N. J. and New York, N. Y. Volume 57, No. 2, February 1959. Five dollars per year.

For 60 Years ...L'HOMMEDIEU...

year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

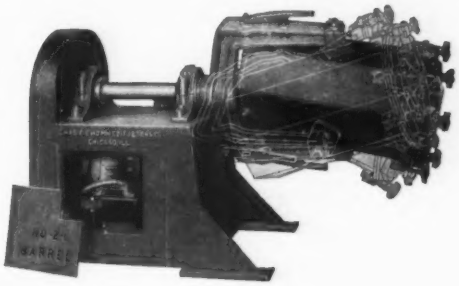
No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.

TYPE L — DOUBLE ACTION BARREL For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.



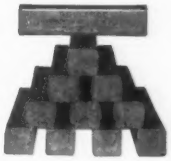
DURABILITY

PRODUCTION

ECONOMY

EFFICIENCY

RELIANCE NUWAY BUFFS FOR FAST CUTTING



RELIANCE EXTRUDED COMPOSITIONS

STANDARD SIZE 2 x 2 x 10"

THEY CUT

THEY CLEAN

THEY COLOR

THE ANSWER TO INCREASED PRODUCTION AT LOWER COSTS

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS OF METAL FINISHING EQUIPMENT AND SUPPLIES

GENERAL OFFICE AND FACTORY

4521 OGDEN AVE. CHICAGO 23, ILL.

Chas. B. Little Co.
Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

Branches:
Cleveland & Los Angeles

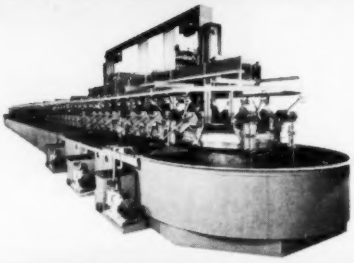
New machine for dipping processes...

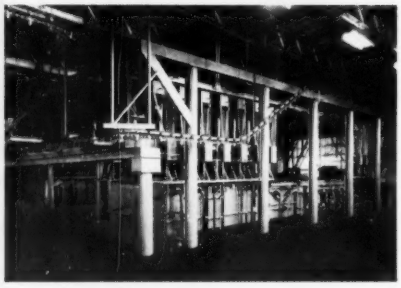
Crown "M-P" Multi-Purpose automatic processing conveyor

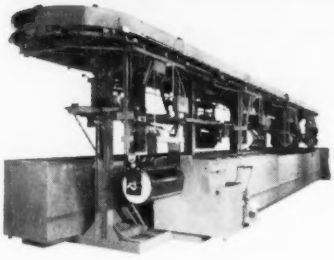
Crown M-P (Multi Purpose) Conveyors are a new development in basic design and control that brings automatic dipping processing to all industry for multi cycle processing in plating—anodizing—painting—phosphatizing and rubber dipping operations. Using the basic "M-P" concept, machines can be built to meet your specific requirements by incorporating one or several of these important Crown features:

- **Each carrier can be set for one of several different cycles.**
- **One machine that can plate two or three different metals.**
- **Horizontal and oblique barrels and even racks can operate on the same machine.**
- **Rack and barrel work can be plated at two different voltages on one machine.**
- **Work can be plated at four different thicknesses at the same time.**
- **Size of parts can vary from ¼ inch to 40 feet in length.**
- **Weight per station from ten to three thousand pounds.**
- **Lifts from 12 inches to 12 feet.**
- **Rotation, tilting, or other auxiliary motion during transfer.**
- **Machines of this type have been at work in actual production for over 2 years.**

Some typical "M-P" installations







CROWN

If your process includes a series of dips, you should know more about the Crown "M-P" . . . ask for our Bulletin M-P. Tell us your processing requirements and we will be glad to show you how the "M-P" can save you money.

CROWN RHEOSTAT AND SUPPLY COMPANY
1965 Pratt Boulevard • Elk Grove Village, Illinois

Now! An alkaline rust and smut remover that really works!

NEW WYANDOTTE FERLON

Simple to use, foolproof in action . . . eliminates metal etching and hydrogen embrittlement . . . combines several operations into one

Here's another new member of Wyandotte's complete line of advanced, top-quality metal-finishing products: Wyandotte FERLON! It's a versatile, fast-acting alkaline rust and smut remover — for use with or without current — that wins hands down over all other similar products in treating steel!

Here's what FERLON will do:

- **REMOVES RUST AND OXIDES** from steels, including stainless steels, without injury to sound metal. May be used as a simple immersion for light rust, or with current for heavy rust and some scales.
- **REMOVES WEATHER, HEAT, AND CHEMICAL STAINS** from steel, bronze, and copper alloys. Usually a simple dip is all that is required.
- **REMOVES SMUT.** FERLON may be added to steel electrocleaners for improved smut removal. Insures brighter electroplates, reduces roughness.
- **SHORTENS PLATING CYCLES.** FERLON eliminates the acid dip in some plating cycles — shortens cycle up to 30%.
- **REMOVES PHOSPHATE COATINGS AND PAINT** in the same tank with rust, scale, and smut, if desired.
- **ADAPTABLE** for soak tank or electrolytic use in existing equipment.

FERLON represents a big step forward in the metal-finishing industry. Chances are its versatility will shorten your production operations and save you money. Contact your nearest Wyandotte representative for a demonstration today. Or clip and mail coupon. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte
CHEMICALS
J. B. FORD DIVISION

The Best in Chemical Products for Metal Finishing

Wyandotte Chemicals Corporation
Wyandotte, Michigan

☐ Please send latest FERLON data sheet

☐ Have representative call

Name_____

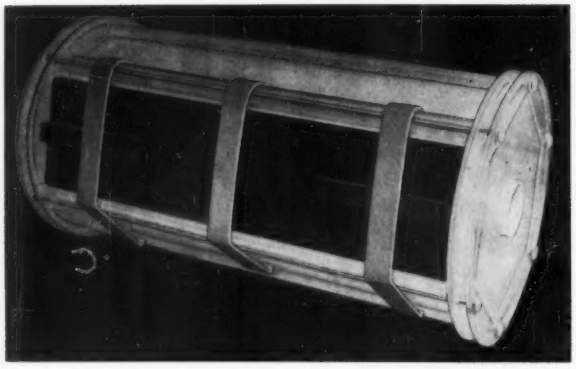
Firm_____

Address_____

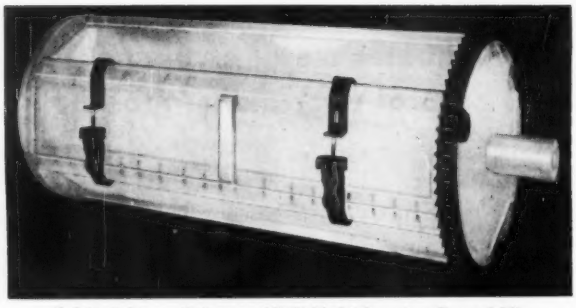
City_____ Zone____ State_____

TRUSSED-RIB *or* ALL-WELDED . . .

Take Your Choice!

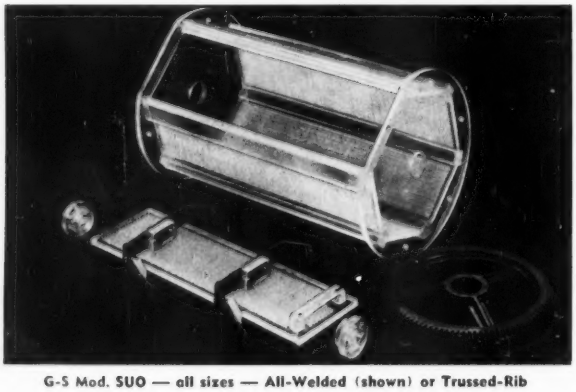


G-S Mod. GS — all sizes — Trussed-Rib (shown) or All-Welded



G-S Mod. SL — all sizes — All-Welded (shown) or Trussed-Rib

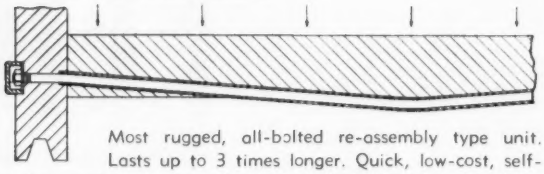
G-S Mod. SUN — all sizes — All-Welded (shown) or Trussed-Rib



G-S Mod. SUO — all sizes — All-Welded (shown) or Trussed-Rib

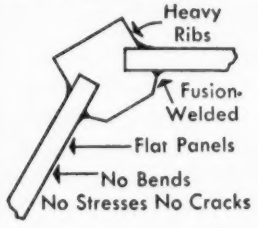
Only G-S Replacement Cylinders are available Both Ways: Trussed-Rib (All-Bolted) or All-Welded Construction. Outperform All Other Makes 3 to 1 at Lower Cost!

Trussed-Rib Construction



Most rugged, all-bolted re-assembly type unit. Lasts up to 3 times longer. Quick, low-cost, self-replacement of all parts. Available in H-T Plexiglas, G-S Polydur, Tempron or in any combination of heads, ribs and panels.

All-Welded Construction



Most rugged permanent-type unit. No formed or molded sections to crack and separate under heat. Welded joints and seams stronger than the material itself. Available in H-T Plexiglas, G-S Polydur or Tempron.

Only G-S Offers You All These Exclusive Performance Features: Heavy 2" sq. ribs for greater strength, better tumbling action. **Temperatures to 220°F** for "hot" processes other makes can't tolerate. **Loads to 275 lbs.** for more production. **17½% More Perforations** for better, faster plating. **100% Thru-Cycle** for "express" operations. **Fit all makes superstructures** for all sizes, types, ages.

G-S means Greater Savings!

Complete Equipment for your Still Plating and Barrel Plating. Performance-Proven in Years of Service at 2/3 Lower Maintenance Cost.

G-S Replacement Cylinders
Models to fit all makes, types, sizes, ages of superstructures.

G-S "Cogged-V-Belt" Drive Conversions
Cylinder-Superstructure combinations to fit other makes of tanks.

G-S "Cogged-V-Belt" Drive Barrels
Complete with tanks. The plating barrel with **more features for better, faster plating** — higher temperatures, heavier loads, longer life, less maintenance.

G-S Tanks, Liners, Hoods, Motor Drives, Dryers, Chute Loaders, etc.

Investigate the low-cost G-S conversion plan for matching your present types of tanks, saddles and drives in your plant. Learn how it pays for itself in maintenance savings alone. Write today.

The G. S. Equipment Co.

15583 Brookpark Rd., Cleveland 35, Ohio, CLearwater 2-4770

announcing a new service to

production supervisors

of metalworking plants

With this issue, The Dow Chemical Company begins a special series of important advertisements on a subject of dollars-and-cents interest to people in manufacturing.

subject: metal cleaning

These advertisements summarize, for quick reading, an interesting variety of reports on specific metal cleaning problems and applications. These reports come from distributors of Dow solvents who serve industry throughout the United States. We hope these reports will be helpful to manufacturing people concerned with improving metal cleaning and finishing operations, and selecting the right metal cleaning agent for a specific job.

The series begins on the following pages with "Metal Cleaning Report No. 1" in which a new service for users of industrial solvents is offered for the first time. This service provides invaluable technical assistance to every plant with a metal cleaning operation. (In addition, you'll find a complete listing of Dow solvents distributors for easy reference.)

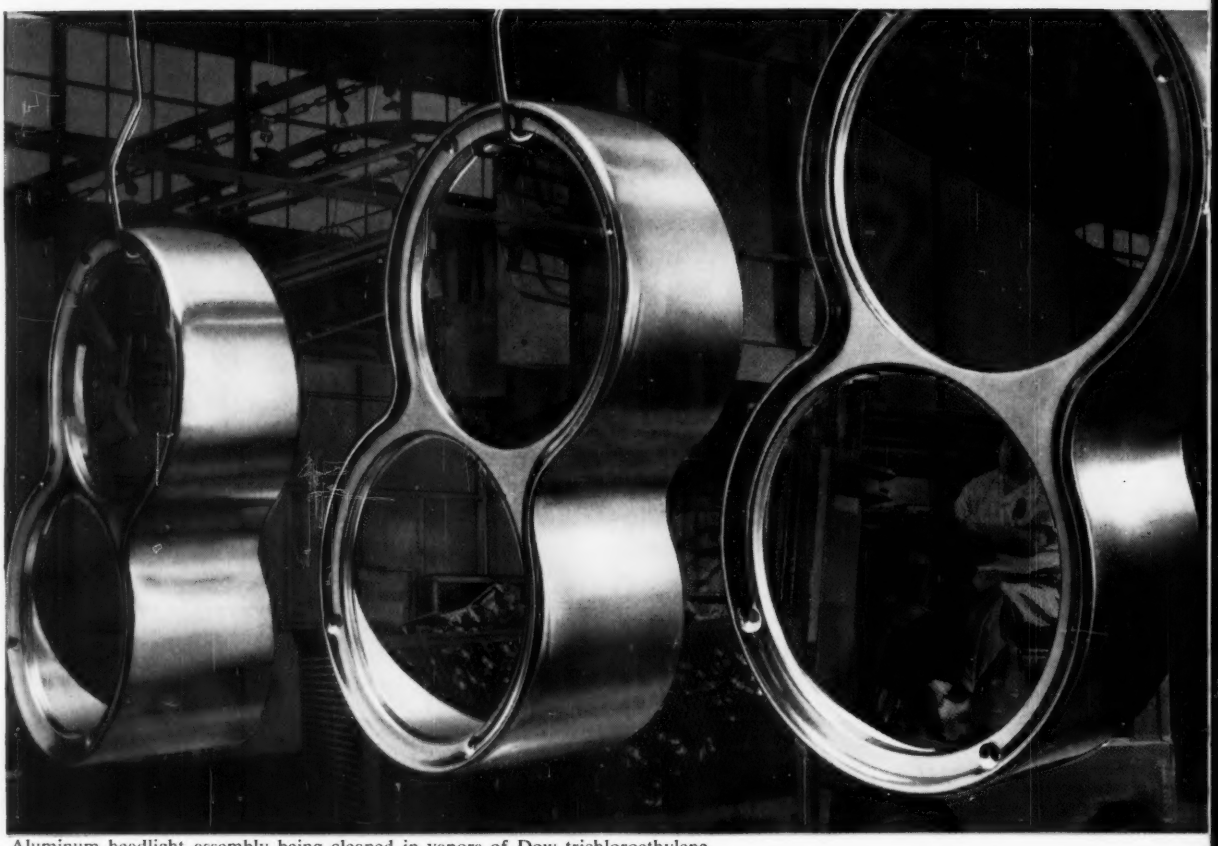
DOW

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

DOW

metal cleaning report no. 1

case histories from your Dow Solvents Distributor



Aluminum headlight assembly being cleaned in vapors of Dow trichloroethylene.

DOW FIELD-LAB TEAM SOLVES DEGREASING RIDDLE

Bay City, Mich.—Manufacturer of auto parts reported faulty still was causing dirty distillate in his trichloroethylene degreasing operation. Dow field team went in, did thorough check of whole operation. Discovered not one, but three trouble spots: (1) Water separator on degreasing unit working improperly; (2) Excess water in stamping oil on parts being cleaned (Dow lab finding); (3) Faulty steam injection valve on still. Valve replaced, water separator repaired, and new stamping oil put in use. Plant now getting good cleaning action first time through vapor degreasing unit using Dow trichloroethylene. Key to solution was skill and thoroughness of trained Dow solvents team.

Time and time again, Dow solvents distributors help manufacturers improve cleaning and stripping operations. And for two good reasons: (1) Dow offers the widest line of chlorinated solvents for modern industry; (2) Dow backs its distributors to the hilt with technical information and on-the-job help. Chances are good that one of the many Dow industrial solvents can help smooth out your operations, too. Dow solvents are made to high purity standards and each is designed to do a specific job and do it well. For help on your metal cleaning problems, call on the nearby Dow solvents distributor. His name is listed on the next page.

THE DOW CHEMICAL COMPANY • MIDLAND, MICH.

NEW COLD CLEANER SAVES BIG DOLLAR

Detroit, Mich.—Expensive fluorinated cleaner was being used by manufacturer to remove paraffin oils from refrigeration compressors. Key requirement: clean parts without damaging insulation varnish on motor windings. Dow solvent team invited in. Observations pointed to Chlorothene® (Dow 1,1,1-trichloroethane, inhibited). Compressors cleaned with Chlorothene and air purged immediately after. Lab tests proved Chlorothene cleaned effectively, safely, without damaging insulating varnish. Company switched to Chlorothene, effected dollar savings while getting safe, sure cleaning.

PERCHLOROETHYLENE KEY

Los Angeles, California—Nationally known lock manufacturer was having difficulty cleaning plated metal parts. Door handles and face plates were coming off trichloroethylene degreasing line with marring water spots. Dow called in on problem. Recommended switch to Dow perchloroethylene. Higher boiling point and longer cleaning action resulted in spotless parts. Lock maker now saving time, money, with efficient perchloroethylene degreasing.

FREE . . .
TECHNICAL SERVICE
on 24-hour notice

Your Dow solvents distributor will gladly help you with any problems you're experiencing with metal cleaning solvents. He'll have a trained solvents specialist en route to your plant within 24 hours after your call is received!

Ask your Dow solvents distributor for details.

STOP-OFF LACQUER STRIPPED FAST

Stratford, Conn.—Major aircraft engine manufacturer was having trouble removing stop-off lacquer used on steel and aluminum parts selectively plated. Parts were being soaked and rinsed in flammable thinner. Process was slow, results unsatisfactory. Dow solvents distributor suggested vapor degreasing with Dow methylene chloride. Parts were run through vapors, then rinsed with spray lance application of m.c. System worked. Lacquer stripped off clean in matter of minutes. Flammability hazard eliminated. Problem marked solved.

CHLOROTHENE®
TRICHLOROETHYLENE
PERCHLOROETHYLENE
METHYLENE CHLORIDE

See Your Dow Solvents Distributor First!

FOR HELPFUL METAL CLEANING INFORMATION
get in touch with your Dow Solvents Distributor

DOW

LETTER KEYS: (C)—Chlorothene®; **(M)**—Methylene Chloride; **(P)**—Perchloroethylene (Industrial); **(T)**—Trichloroethylene

ALABAMA
BIRMINGHAM—Wittichen Chemical Company **(C M P)**
BIRMINGHAM—F. H. Ross and Company **(C M P T)**
MOBILE—Barada and Page, Inc. **(C M)**
MOBILE—McKesson & Robbins, Inc. **(C M P T)**
MOBILE—F. H. Ross and Company **(C M P)**
MONTGOMERY—Wittichen Chemical Company **(C M P)**

ARIZONA
PHOENIX—Braun Chemical Company **(C M P T)**
PHOENIX—Western Chemical Company **(C M P)**
TUCSON—Western Chemical Company **(C M P)**

CALIFORNIA
LOS ANGELES—Braun Chemical Company **(C M P T)**
LOS ANGELES—McKesson, Mefford Chemical Division **(P)**
LOS ANGELES—Pemaco, Inc. **(P T)**
OAKLAND—B. N. Meacham Company **(C)**
SAN DIEGO—Braun Chemical Company **(C M P T)**
SAN DIEGO—Buel Town Company **(T)**
SAN FRANCISCO—Braun-Knecht-Heimann Co. **(C M P T)**
SAN FRANCISCO—Phil L. Dostal Company **(P)**
SOUTH GATE—American Mineral Spirits **(P)**

COLORADO
DENVER—Braun-Knecht-Heimann Company **(C M)**
DENVER—Chemical Sales Company **(C M P T)**
DENVER—Mine and Smelter Supply Company **(C M P T)**
GRAND JUNCTION—C. D. Smith Co., Chemical Div. **(C P T)**

CONNECTICUT
NEW HAVEN—H. Krevit and Company, Inc. **(P T)**
SHELTON—Axton-Cross Company **(C M P T)**
SOUTH NORWALK—McKesson and Robbins, Inc. **(C M P T)**

FLORIDA
JACKSONVILLE—F. H. Ross and Company **(C M P T)**
JACKSONVILLE—Amica Burnett Chemical Co. **(C M P T)**
MIAMI—Amica Burnett Chemical Company **(C M P T)**
MIAMI—Biscayne Chemical Laboratories **(C M P T)**
ORLANDO—Atlantic Chemicals, Inc. **(C M P T)**

GEORGIA
ATLANTA—McKesson and Robbins, Inc. **(C M P T)**
ATLANTA—F. H. Ross and Company **(C M P T)**
ATLANTA—Southern States Chemical Company **(C M P T)**
COLUMBUS—F. H. Ross and Company **(C M T)**
DUBLIN—Textile Aniline Chemical Company **(T)**

IDAHO
BOISE—Van Waters and Rogers, Inc. **(C M P)**

ILLINOIS
AURORA—River Valley Chemical Company **(C M P T)**
CHICAGO—Central Solvents and Chemicals **(C M P)**
CHICAGO—C. P. Hall Company **(C M P T)**
CHICAGO—Keystone Aniline and Chemical Co. **(C P)**
CHICAGO—McKesson & Robbins, Inc. **(C M P T)**
CHICAGO—Joseph Turner and Company **(C M P T)**
DECATUR—McKesson & Robbins, Inc. **(C M P T)**
EFFINGHAM—Wabash Independent Oil Company **(P T)**
PEORIA—McKesson & Robbins, Inc. **(C M P T)**
ROCKFORD—Industrial Oil and Chemical Company **(C)**
ROCKFORD—Viking Chemical Company **(C M P T)**

INDIANA
EVANSVILLE—Charles Leich and Company **(P)**
FT. WAYNE—Hoosier Solvents and Chemicals **(C M P)**
FT. WAYNE—Inland Chemical Co. **(C M T)**
INDIANAPOLIS—Hoosier Solvents and Chemicals **(C M P)**
INDIANAPOLIS—Wm. Lynn Chemical Company **(C M P)**
INDIANAPOLIS—Lynn Solvents Corporation **(T)**
INDIANAPOLIS—Ulrich Chemical Company, Inc. **(T)**
KOKOMO—Plating Products, Inc. **(P T)**
LOGANSPORT—Plating Products, Inc. **(P T)**
SOUTH BEND—Inland Chemical Co. **(C M P T)**
SOUTH BEND—Stevens Oil Company **(C M P)**

IOWA
BETTENDORF—Barton Naptha Company **(C M P T)**
BURLINGTON—McKesson and Robbins, Inc. **(C M P T)**
CEDAR RAPIDS—McKesson and Robbins, Inc. **(C M P T)**
COUNCIL BLUFFS—Barton Solvents, Inc. **(C M P T)**
DES MOINES—Barton Naptha Company **(C M P T)**
SIOUX CITY—McKesson and Robbins, Inc. **(P)**
SUMNER—Overton Chemical Sales **(C)**

KANSAS
WICHITA—Barada and Page, Inc. **(C M)**
WICHITA—Reid Supply Company **(C P T)**

KENTUCKY
LOUISVILLE—Dixie Solvents and Chemicals **(C M P)**
LOUISVILLE—Gans Chemical and Supply Company **(P)**
LOUISVILLE—McKesson and Robbins, Inc. **(C M P T)**

LOUISIANA
BATON ROUGE—Barada and Page, Inc. **(C M)**
LAKE CHARLES—Barada and Page, Inc. **(C M)**
NEW ORLEANS—Barada and Page, Inc. **(C M)**
NEW ORLEANS—Southern Solvents and Chemicals **(C M P T)**

MAINE
LEWISTON—Polar Chemical Company **(C M P T)**

MARYLAND
BALTIMORE—B. J. Howard Company **(C M P T)**
BALTIMORE—Leidy Chemicals Corporation **(C M P)**
BALTIMORE—Seiler Chemicals **(C)**
BALTIMORE—Tilley Chemical Company **(T)**

MASSACHUSETTS
BOSTON—Howe and French, Inc. **(C M)**
BOSTON—Linder and Company, Inc. **(C M P T)**
BOSTON—McKesson and Robbins, Inc. **(C M P T)**
EVERETT—Sessions-Gifford Co., Inc. **(C M P T)**
FRAMINGHAM—Axton-Cross Corp. of Mass. **(C P T)**
HINGHAM—Stephens & Roger, Inc. **(C M P T)**
HOLYOKE—Eastern Chemicals, Inc. **(M)**
SPRINGFIELD—Chemical Corporation **(C M P T)**
SPRINGFIELD—Hampden Color and Chemical Co. **(C M P)**
STONEHAM—George Mann & Co. **(C M P T)**
WORCESTER—George H. Clark and Co. **(C M P T)**

MICHIGAN
DETROIT—Eaton Chemical and Dyestuff **(C M)**
DETROIT—McKesson and Robbins, Inc. **(C M P T)**
DETROIT—Western Solvents and Chemicals **(C M P)**
DETROIT—Whitfield Chemical Company **(P)**
EAST DETROIT—Sherwood Chemical Company **(P)**
ESCANABA—Haviland Products Company **(C M P)**
FERNDALE—Manpro Corporation **(C M P T)**
GRAND RAPIDS—P. B. Gast and Sons Company **(C)**
GRAND RAPIDS—Haviland Products Company **(C M)**
GRAND RAPIDS—Wolverine Solvents and Chemicals Co. **(C M P)**
LANSING—Carrier Stephens Company **(C P)**
LANSING—Wheaton Chemical Company **(C P T)**
LUDINGTON—P. B. Gast and Sons Company **(C)**

MINNESOTA
MINNEAPOLIS—W. H. Barber Company **(P T)**
MINNEAPOLIS—McKesson and Robbins, Inc. **(C M P T)**
MINNEAPOLIS—Tripoli Refining Corporation **(M P T)**
ST. PAUL—Lyons Chemicals, Inc. **(C M P)**

MISSISSIPPI
JACKSON—F. H. Ross and Company **(C M P)**

MISSOURI
KANSAS CITY—Barada and Page, Inc. **(C M)**
KANSAS CITY—Missouri Solvents and Chemicals **(C M P)**
KANSAS CITY—Sherwood and Company, Inc. **(C M P T)**
ST. LOUIS—Barada and Page, Inc. **(C M)**
ST. LOUIS—Independent Oil Company **(C M P T)**
ST. LOUIS—McKesson and Robbins, Inc. **(C M P T)**
ST. LOUIS—G. S. Robins and Company **(C M P)**
ST. LOUIS—St. Louis Solvents and Chemicals **(C P T)**
ST. LOUIS—Missouri Solvents and Chemicals **(C M P)**

NEBRASKA
OMAHA—Barton Solvents, Inc. **(C M P T)**
OMAHA—McKesson and Robbins, Inc. **(C M P T)**

NEW JERSEY
CAMDEN—Callahan Chemical Company **(M P T)**
EAST PATERSON—Aetna Color and Chemical Company **(C M P T)**
MURRAY HILL—American Mineral Spirits **(C M P T)**
NEWARK—American Oil and Supply **(C P)**
NEWARK—National Oil and Supply Company **(C M P T)**
PALISADE PARK—Philip A. Hunt Company **(C)**
VINELAND—Lirio Chemical Company **(C T)**

NEW MEXICO
ALBUQUERQUE—Braun Chemical Company **(C M P T)**
ALBUQUERQUE—Edmunds Chemical Company **(C M P T)**

NEW YORK
ALBANY—Eastern Chemical **(C M P T)**
ATHENS—Spick Products Company **(P T)**
BINGHAMTON—Collier Chem. **(C M)**
BRONX—Elco Solvents Corporation **(M P T)**
BROOKLYN—Enequist Chemical Company **(C P)**
BUFFALO—Buffalo Solvents and Chemicals **(C M P T)**
BUFFALO—Chemical Sales Corporation **(C M P)**
EDGEMERE—Hagan Industrial Supply **(P T)**
GLOVERSVILLE—Eastern Chemicals, S. H. Ireland Div. **(C M)**
LONG ISLAND CITY—Peerless Oil and Chemical **(C M P T)**
NEW YORK—American Chemicals, Inc. **(C M P T)**
NEW YORK—McKesson and Robbins, Inc. **(C M P T)**
POUGHKEEPSIE—Duso Chemical Company **(C)**
RENSSELAER—Eastern Chemicals, Inc. **(C M)**
ROCHESTER—Chemical Sales Corporation **(C M P T)**
ROCHESTER—J. H. Rae Oil Company, Inc. **(P T)**
SYRACUSE—Eastern Chemicals, Inc. **(C M)**
UTICA—Monarch Laboratories **(C M P)**

NORTH CAROLINA
CHARLOTTE—F. H. Ross and Company, Inc. **(C M P T)**
CHARLOTTE—Southern States Chemical Co. **(C M P T)**
GREENSBORO—F. H. Ross and Company, Inc. **(C M P T)**

OHIO
AKRON—Farley Solvents Company **(C M P T)**
AKRON—C. P. Hall Company **(C P T)**
CANTON—Bison Corporation **(C P T)**
CINCINNATI—Amsco Solvents and Chemicals **(C M P)**
CINCINNATI—Chipman Supply Company **(T)**
CINCINNATI—Herbert Chemical Company **(P T)**
CINCINNATI—McKesson and Robbins, Inc. **(C M P T)**
CLEVELAND—Man-Gill Chemical Company **(C P T)**
CLEVELAND—McKesson and Robbins, Inc. **(C M P T)**
CLEVELAND—National Solvents Corporation **(C P T)**
CLEVELAND—Ohio Solvents and Chemicals, Inc. **(C M P)**
CLEVELAND—R. W. Renton Company **(C P T)**
COLUMBUS—McKesson and Robbins, Inc. **(C M P T)**
DAYTON—Industrial Chemical Products Co. **(C P T)**
DAYTON—Ottoson Solvents, Inc. **(T)**
LIMA—Thomson Chemical Company **(C P T)**
TOLEDO—Inland Chemical Co. **(C M P T)**
TOLEDO—Toledo Solvents and Chemicals **(C M P)**
TOLEDO—M. I. Wilcox Company **(C P T)**
YOUNGSTOWN—Rhiel Supply Company **(C M P T)**

OKLAHOMA
OKLAHOMA CITY—Barada and Page, Inc. **(C M)**
TULSA—Barada and Page, Inc. **(C M)**
TULSA—Chemical Products, Inc. **(C M P T)**

OREGON
PORTLAND—Van Waters and Rogers **(C M P)**

PENNSYLVANIA
CONSHOHOCKEN—American Mineral Spirits **(C M P T)**
EASTON—Lehigh Valley Chemical Company **(C M P T)**
ERIE—Monarch Laboratories **(C M P T)**
McKEES ROCK—Apex Soap and Sanitary Corp. **(C P T)**
PHILADELPHIA—Alex C. Fergusson Company **(C P T)**
PHILADELPHIA—McKesson and Robbins, Inc. **(C M P T)**
PHILADELPHIA—Phillips and Jacobs, Inc. **(C M)**
PHILADELPHIA—Pioneer Salt Company **(C M P T)**
PHILADELPHIA—George Senn, Inc. **(C M P T)**
PITTSBURGH—Carmac Chemical Company, Inc. **(C P)**
PITTSBURGH—Carman-Pittsburgh Company **(C P T)**
PITTSBURGH—Dacar Chemical Products Company **(C P T)**
PITTSBURGH—Ft. Pitt Chemical Company **(C M P)**
PITTSBURGH—McKesson and Robbins, Inc. **(C M P T)**
READING—R. W. Eaken, Inc. **(C P T)**
READING—Textile Chemical Company **(C P)**
SCRANTON—Scranton Chemical Company **(C P T)**
YORK—Industrial Solvents and Chemicals **(C P T)**

RHODE ISLAND
PROVIDENCE—George Mann and Company **(C M P T)**
PROVIDENCE—Sessions-Gifford Company, Inc. **(C M P T)**

SOUTH CAROLINA
CHARLESTON—Burris Chemical Company **(C P T)**
GREENVILLE—Frank H. Ross & Co. **(C M P T)**
GREENVILLE—Southern States Chemical Co. **(C M P T)**
SPARTANBURG—Moreland Chemical Company, Inc. **(C M P T)**

TENNESSEE
CHATTANOOGA—Chapman Chemical Co. **(C M P T)**
CHATTANOOGA—Wilson Sales Company **(C M P T)**
KINGSPORT—Chem-I-Dent, Inc. **(C P T)**
MEMPHIS—Chapman Chemical Company **(C M P T)**
MEMPHIS—C. P. Hall Company **(C M P T)**
MEMPHIS—Ideal Chemical and Supply Co. **(C M P T)**
NASHVILLE—Chapman Chemical Company **(C M P T)**
NASHVILLE—Wilson Sales Company **(C M P T)**

TEXAS
AMARILLO—State Chemical Company **(C M P T)**
AUSTIN—R. M. Hughes Company, Inc. **(C M P T)**
BEAUMONT—Arthur Dooley and Son **(C M P T)**
CORPUS CHRISTI—Barada and Page, Inc. **(C M)**
DALLAS—Barada and Page, Inc. **(C M)**
DALLAS—McKesson & Robbins, Inc. **(C M P T)**
DALLAS—Texas Solvents and Chemicals Co. **(C)**
DALLAS—Van Waters and Rogers, Inc. **(C M P T)**
EL PASO—Baron Chemical Company **(C M P T)**
EL PASO—Braun Chemical Company **(C M P T)**
EL PASO—Mine and Smelter Supply Company **(P)**
FORT WORTH—Barada and Page, Inc. **(C M)**
FORT WORTH—Worth Chemical Products Co. **(C M P)**
HOUSTON—Barada and Page, Inc. **(C M)**
HOUSTON—W. H. Curtain and Company **(P)**
HOUSTON—Dixie Chemical Company **(C M P T)**
HOUSTON—R. M. Hughes Company, Inc. **(C M P T)**
HOUSTON—McKesson, Texas Chemical Division **(C M P T)**
HOUSTON—Texas Solvents and Chemicals Co. **(C M P)**
HOUSTON—Van Waters and Rogers, Inc. **(C M P T)**
LUBBOCK—State Chemical Company **(C M P T)**
MIDLAND—State Chemical Company **(C M P T)**
ODESSA—Barada and Page, Inc. **(C M)**
SAN ANTONIO—R. M. Hughes Company, Inc. **(C M P T)**
SAN ANTONIO—McKesson and Robbins, Inc. **(C M P T)**

UTAH
SALT LAKE CITY—Braun-Knecht-Heimann Co. **(C M P)**

VIRGINIA
NORFOLK—Taylor Salt and Chemical Company **(C P T)**
RICHMOND—Phipps and Bird, Inc. **(C M P)**
ROANOKE—Havnaer Supply Company **(C M P T)**

WASHINGTON
SEATTLE—Van Waters and Rogers, Inc. **(C M P)**
SPOKANE—Van Waters and Rogers, Inc. **(C M P)**

WEST VIRGINIA
CHARLESTON—B. Preiser and Company **(C M P T)**
FAIRMONT—Fairmont Machinery, Fairmont Supply **(C P T)**
HUNTINGTON—Cabell Chemical Company **(C P T)**

WISCONSIN
CHIPPEWA FALLS—Lyons Chemical **(C M P T)**
MADISON—North Central Chemicals **(C M P T)**
MILWAUKEE—McKesson and Robbins, Inc. **(C M P T)**
MILWAUKEE—Wisconsin Solvents and Chemicals **(C M P)**
WAUKESHA—Fred Portz and Son **(C T)**

See Your Dow Solvents Distributor First!

PLATING BARRELS REPAIRED and REPLACED AT A NEW LOW COST!

a real benefit from Project Alert

The upswing in business has started! Are your plating facilities geared to deliver peak performance?

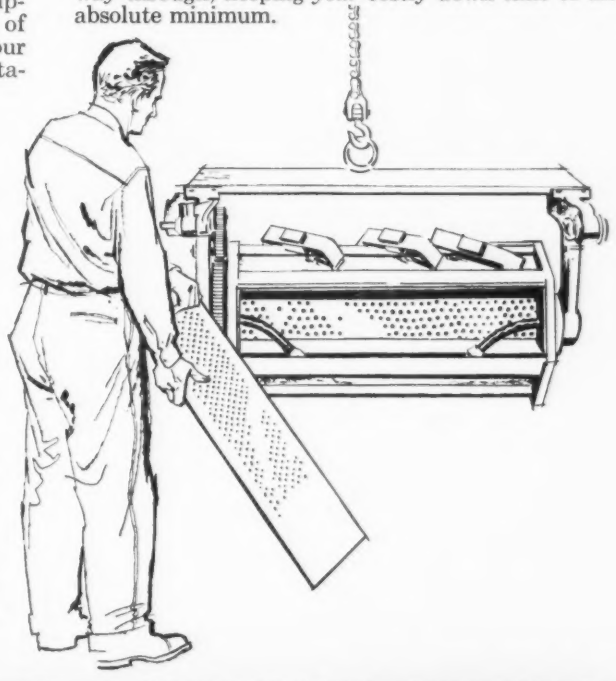
Don't take chances. Avoid costly down time during periods of high production. Inventory your equipment needs *now* . . . especially the condition of your plating barrel equipment. Then let your Udylite sales engineer give you on-the-job quotations for repairs or replacements.

Repairs or replacements by UDYLITE offer these advantages:

1. **IMMEDIATE QUOTATIONS given by Udylite salesman right in your shop!**
2. **ALL REPAIRS or REPLACEMENTS WITH GENUINE UDYLITE PARTS! You're assured of finest Udylite engineering, highest quality!**
3. **PARTS FACTORY INSTALLED by trained barrel equipment specialists.**
4. **FAST, GUARANTEED DELIVERY of equipment sent to Udylite. Special department set up to expedite your order.**

Let Udylite help you get your entire plating operation in top working order, ready to go at top capacity. Your Udylite sales engineer will soon be calling on you. But if you need priority service write, phone or wire directly to:

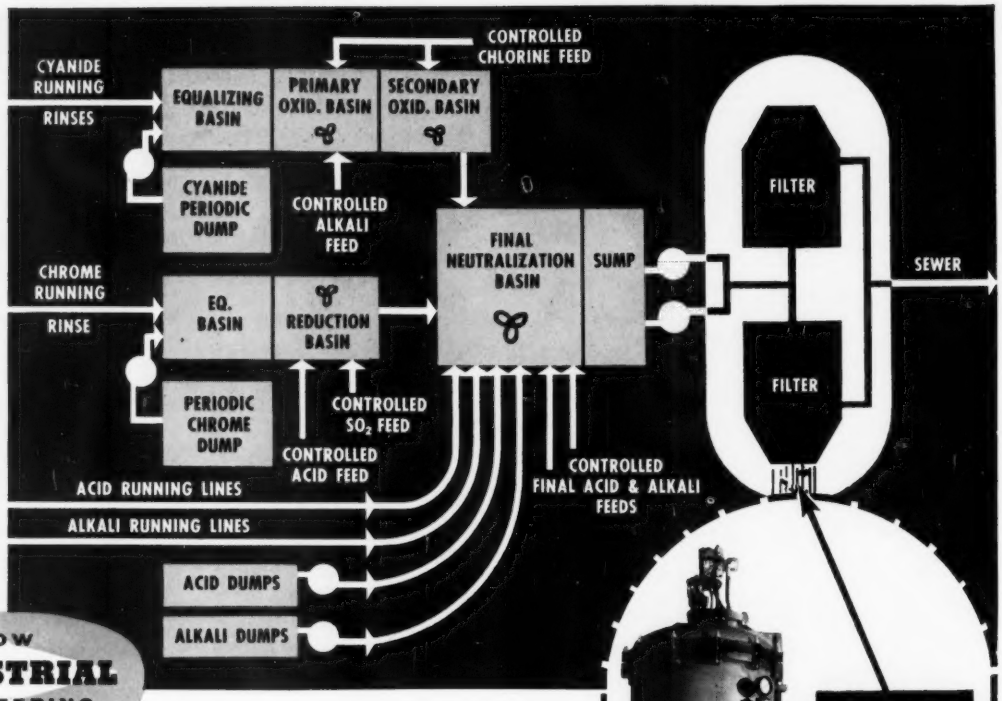
When your equipment is sent to us, you will be guaranteed a firm return delivery date. Because a special department will handle your order all the way through, keeping *your* costly down time to an absolute minimum.



the udylite corporation

detroit 11, michigan • world's largest plating supplier

PROJECT ALERT



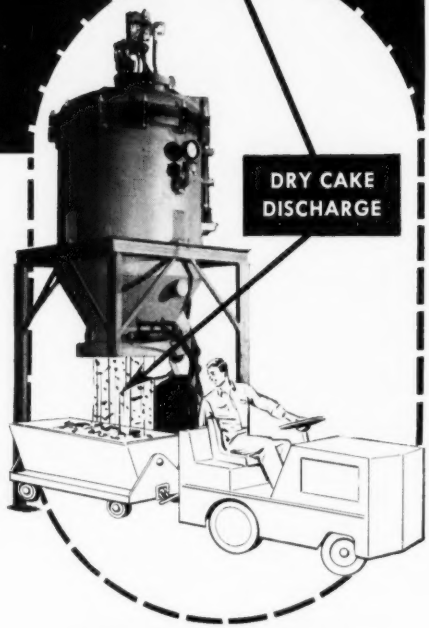
HOW **INDUSTRIAL** ENGINEERING PAYS OFF...

Cutting Costs on Plating Waste Disposal

A large midwest plant needed an efficient centralized system for disposal of corrosive wastes from several plating lines.

The answer to their problem was the INDUSTRIAL *engineered system* diagrammed above. This system provides a central basin for neutralization of all the acid, alkali, cyanide and chrome wastes delivered from rinsing operations. Only small amounts of chemicals are added to precipitate the dissolved metals for separation by filtration. The two compact INDUSTRIAL filters extract the solids and discharge a neutral non-toxic effluent to the city sewage system.

The end results reduced equipment costs by one-half—two push-button Vertical Leaf Filters *replace* expensive clarifier mechanisms, sludge pumps and vacuum filter! . . . 90% LESS SPACE required for entire system! . . . SIMPLE INSTALLATION—no excavation or complex concrete work! . . . DRY CAKE WASTE DISPOSAL—discharged by mechanical shakers directly from filters into trucks!



SIMPLE, FAST CAKE DISPOSAL

There's no mess, no time lost with this rapid-cleaning INDUSTRIAL filter. A simple mechanical shaker discharges the dry cake through the convenient bottom outlet—directly into a waiting disposal truck that can be driven away immediately.

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. COMPANY
5906 Ogden Avenue, Chicago 50, Illinois

Call or write INDUSTRIAL to find out how an engineered system like this can solve your specific plating waste and recovery problems.

P-358

PRESSURE FILTERS ◆ ION & HEAT EXCHANGERS ◆ WASTE-TREATING EQUIPMENT

THIS COATING HAS "LIFE INSURANCE"

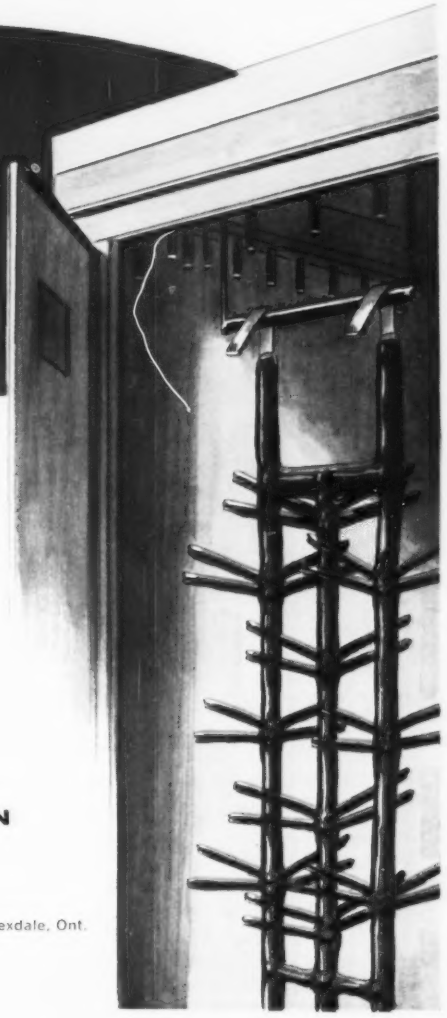
...that's one more of the advantages of Unichrome Coating 218X

Racks are ready for long life under roughest service conditions with Unichrome Coating 218X. So tough is this quality plastisol rack insulation, that damage is a rarity. It won't chip, crack, tear . . . is highly resistant to abrasion.

But even if accidental damage does occur, coating life is still not shortened. Coating 218X can be patched and rebaked with no loss of toughness or resiliency. Like new, the rebaked coating will continue to survive strongest plating and cleaning operations, including vapor degreasing cycles.

Platers have been saving maintenance money for over 10 years now with Coating 218X . . . first in the field. They have proved for themselves that *using the best quality at the outset saves most money in the long run.* Send for more details.

Are you using the rack coating that gives you ALL FIVE?



1. *Built-in cure indicator assures maximum performance*
2. *No contamination of plating baths*
3. *Ability to be rebaked for patching*
4. *Nationwide set-up of expert applicators*
5. *Highly qualified technical service.*

UNICHROME

First name in plastisols for all plating purposes . . .

METAL & THERMIT CORPORATION

Member, Vinyl Dispersions Division of the SPI

GENERAL OFFICES: RAHWAY, NEW JERSEY

Pittsburgh • Atlanta • Detroit • E. Chicago • Los Angeles

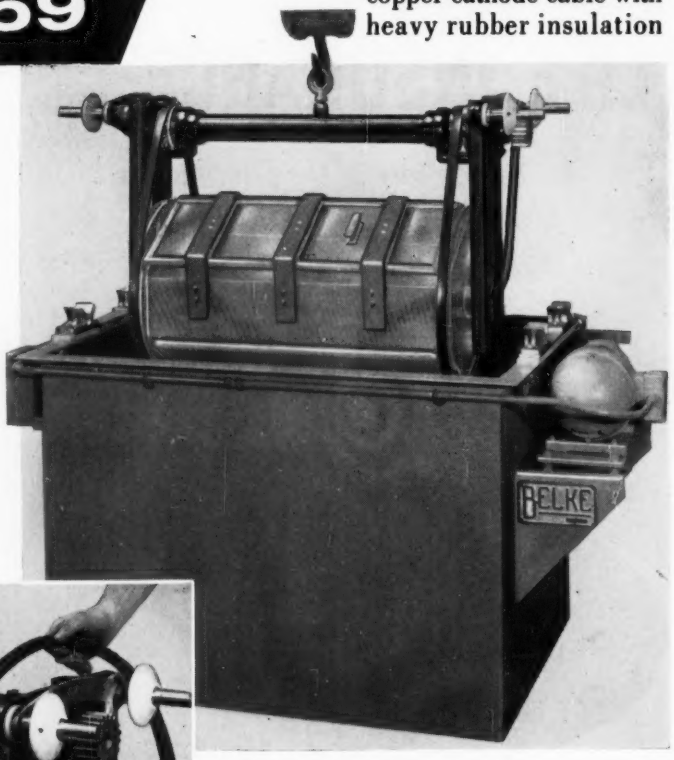
In Canada: Metal & Thermit—United Chromium of Canada, Limited, Rexdale, Ont.

The New BELKE
beautiful & economical
Plating Barrels
for 1959

Completely submerged cylinder operation

Low level superstructure — added clearance for safe transfer of cylinders

One piece 3/4" diameter copper cathode cable with heavy rubber insulation

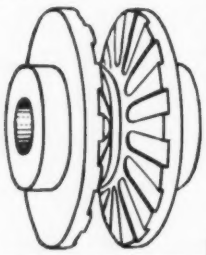


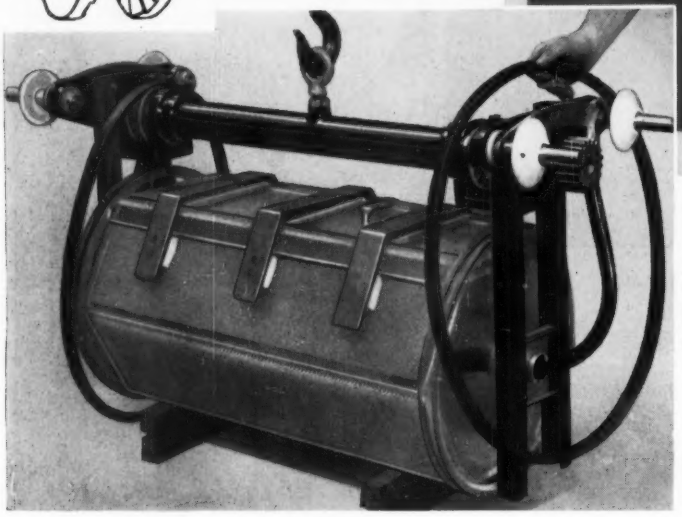
New hanger design of amazing simplicity and beauty

Completely covered with black pastisol. Can be washed clear and clean with a hose in seconds.

Non-skid V-Belt Pulley

Spiral V-Belt Pulley has non-skid cleats that grip plain V-Belt and create tremendous traction. This new non-skid pulley eliminates all need for extra costly and short-lived notched belts—has greater traction and gives many times longer belt life with standard type belts





INSTANT BELT and CYLINDER CHANGE

Lower cylinder on blocks. Lift off belt—put on belt. Lift out cylinder—put in cylinder.—bing, bang done—tool time, zero.

Available with Double Oscillating Cylinders

The 1959 Plating Barrels can be furnished with hanger mounted motor drive.

Heavy duty, long life and low upkeep construction

- Long life, thick wall Teflon bearings
- Hanger guides covered with hard sheet rubber
- One piece hanger bridge completely plastisol coated
- Solid copper saddle-horns with heavy solid copper bar connection to cathode cable
- Uses plain (not notched) V-BELTS—Automotive or industrial V-BELTS can be used, but standard type belts designed to meet the unusual service conditions are recommended

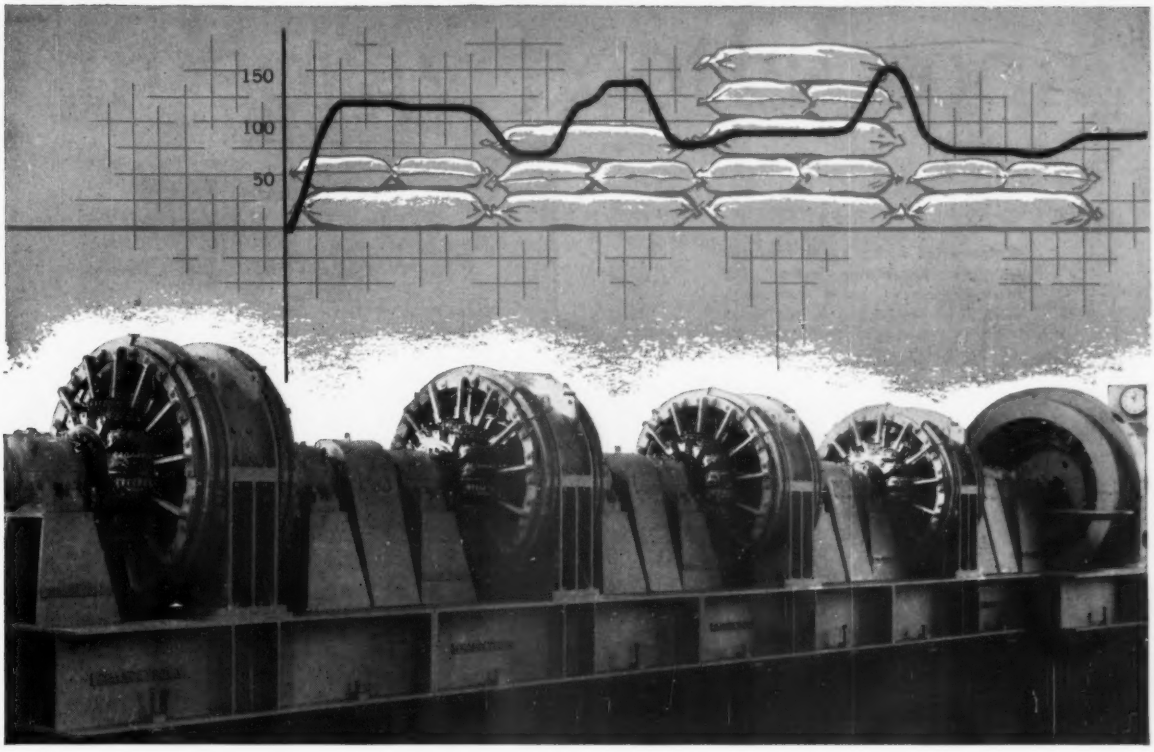
Conventional cylinders are available in Plexiglas, Melamine, Bakelite, Transite, Tempron Hard Rubber. BELKE Double Oscillating Cylinders are available made of Plexiglas.

Whatever your requirements for plating room equipment, send specifications or write.

Belke Manufacturing Company
947 N Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

EXTRA stamina...WHEN YOU NEED IT MOST



...PROOF THAT MOTOR GENERATORS ARE YOUR MOST DURABLE FORM OF POWER CONVERSION

Chandeysson **generators are built with high overload capacity—up to 50% momentarily**

Stamina and durability are built right into Chandeysson Motor Generators to give you more power when you need it most . . . in an emergency. You get overload capacity as great as 50% momentarily and 25% for 2-hour periods . . . without distress or damage. All *this* is the result of Chandeysson's sound engineering, painstaking design, specialized craftsmanship, and thorough testing.

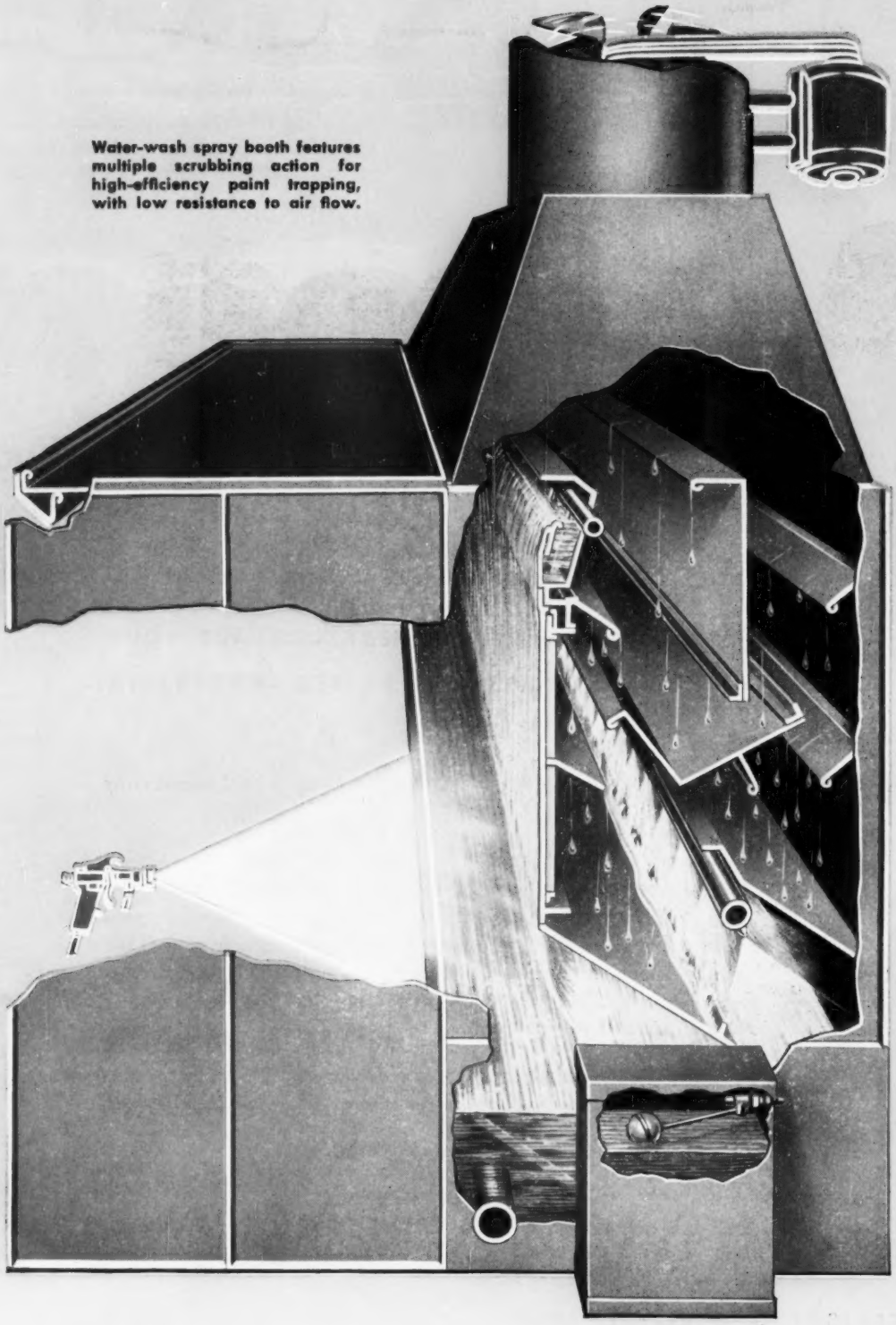
Stamina is just one of many reasons why the plating industry *insists* on Chandeysson low-voltage generators for direct current power needs . . . for extra capacity to meet emergencies at the lowest possible cost.

For full information, write now for new booklet D-103.

CHANDEYSSON ELECTRIC COMPANY

4074 Bingham Avenue • St. Louis 16, Missouri

Why DeVilbiss offers



Water-wash spray booth features multiple scrubbing action for high-efficiency paint trapping, with low resistance to air flow.

you the best value in spray booths today

- **Standardized parts and modular, prefabricated steel panels provide more rigid, more versatile, more durable booths at lower cost!**
- **Specific models, standard or custom-designed, for every type of spraying operation —automatic, electrostatic, or manual!**
- **Each model and type is job-rated, job-proved for guaranteed performance!**
- **Manufactured to the standards of the National Board of Fire Underwriters for spray booths as recommended by the National Fire Protection Association!**

When you choose a DeVilbiss spray booth, you get the unit best suited to your purposes, *at great savings*. That's because DeVilbiss offers economy of operation, efficiency of performance, and ease of installation made possible by scientific adaptation of modular design principles.

Bolt-together construction saves erection time; offers flexibility for revamping or moving booths as operations and plant layouts change. Design and construction features provide excellent paint-trapping efficiency; stay cleaner longer; save maintenance time and expense.

So contact your nearest DeVilbiss branch office for complete details on any of the more than 500 standardized spray booths . . . or write for a copy of Spray Booth Catalog I-7000.

FOR BETTER SERVICE, BUY

DEVILBISS

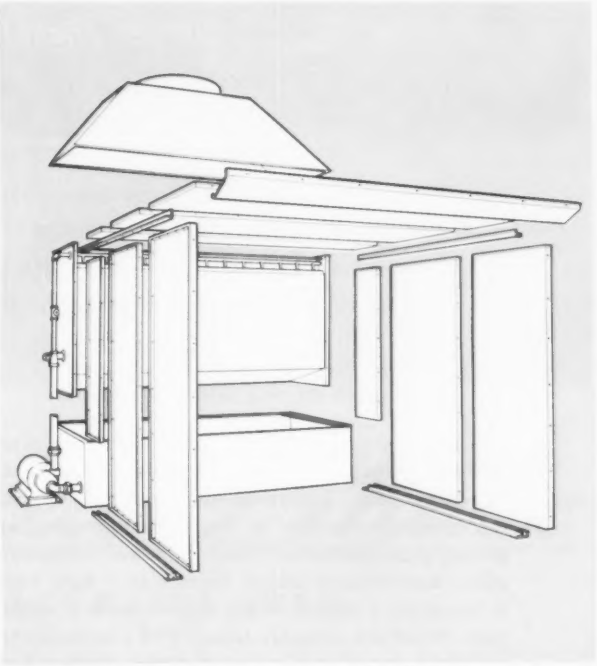
THE DEVILBISS COMPANY

TOLEDO 1, OHIO

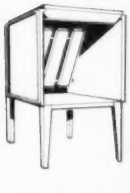
Barrie, Ontario • London, England • São Paulo, Brazil

Branch Offices in Principal Cities

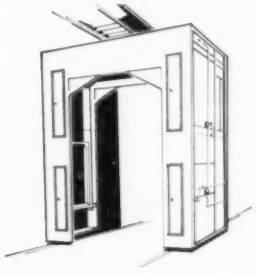
DUST COLLECTORS • INDUSTRIAL POWER WASHERS • FLOW & DIP COATERS
OVENS • SPRAY BOOTHS • AIR COMPRESSORS
SPRAY EQUIPMENT • HOSE & CONNECTIONS • MIST COOLANT UNITS



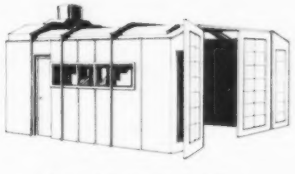
Bolt-together panels of 18-gauge steel, rolled edges, mitered and welded corners provide built-in reinforcement for DeVilbiss Spray Booths. No additional supports or guy wires needed.



Leg-type Spray Booth



Traveling Spray Booth



Enclosed Booth with dust filters

Down-Draft Spray Booth

UNMATCHED CORROSION RESISTANCE

The No. 1 Feature of

HARSHAW PERFLOW PERGLOW DUPLEX *Nickel Plating Process*

Harshaw's research and development laboratory solved the problem of plating nickel on nickel. This, coupled with the use of a sulfur-free nickel plate and a bright nickel from a compatible bath, has made possible a Duplex deposit with unequalled corrosion resistance.

EXCELLENT CORROSION PROTECTION ACHIEVED THROUGH USE OF A SULFUR-FREE DEPOSIT

The Harshaw Chemical Company after years of research and development work was the first to find that a *sulfur-free* nickel offers greater corrosion resistance. This fact led to the development of the Harshaw Perflow nickel plating process. Further research showed that use of the sulfur-free Perflow nickel deposit as a base coating, followed by a bright nickel deposit from a *compatible* bath, would give a Duplex deposit with a further improvement of corrosion resistance. Performance data, by both accelerated tests and outdoor exposure, from leading automobile manufacturers and parts suppliers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to and frequently better than, buffed gray nickel and is unequalled by any bright nickel.

MANY OTHER ADVANTAGES

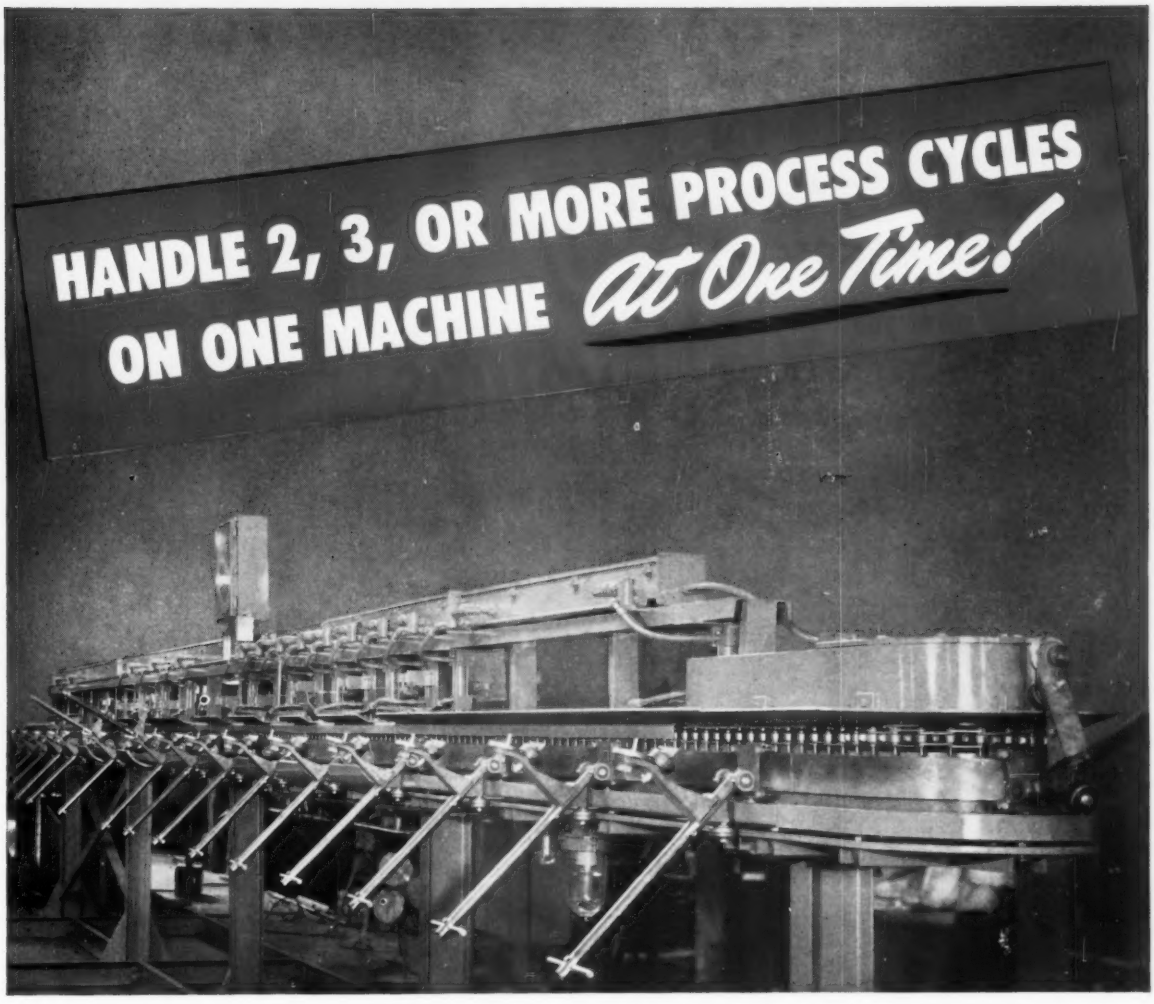
1. Exceptionally high plating speeds —with air or mechanical agitation.
2. Excellent Chrome Coverage.
3. Unsurpassed Leveling Characteristics.
4. Outstanding Brightness.
5. High Tolerance to Impurities.
6. Excellent Adhesion.
7. Excellent Ductility at Full Brightness.
8. Simplified Control — Stable over extended periods of operation.
9. Controlled Stress.
10. Uniform Protective and Decorative plate on both steel and zinc die castings.

THE HARSHAW CHEMICAL CO.

1945 EAST 97TH STREET • CLEVELAND 6, OHIO

Chicago • Cincinnati • Cleveland • Detroit • Houston
Los Angeles • Hastings-On-Hudson • Philadelphia • Pittsburgh

HARSHAW



LASALCO'S *Select-O-Matic*

MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

Write Today!

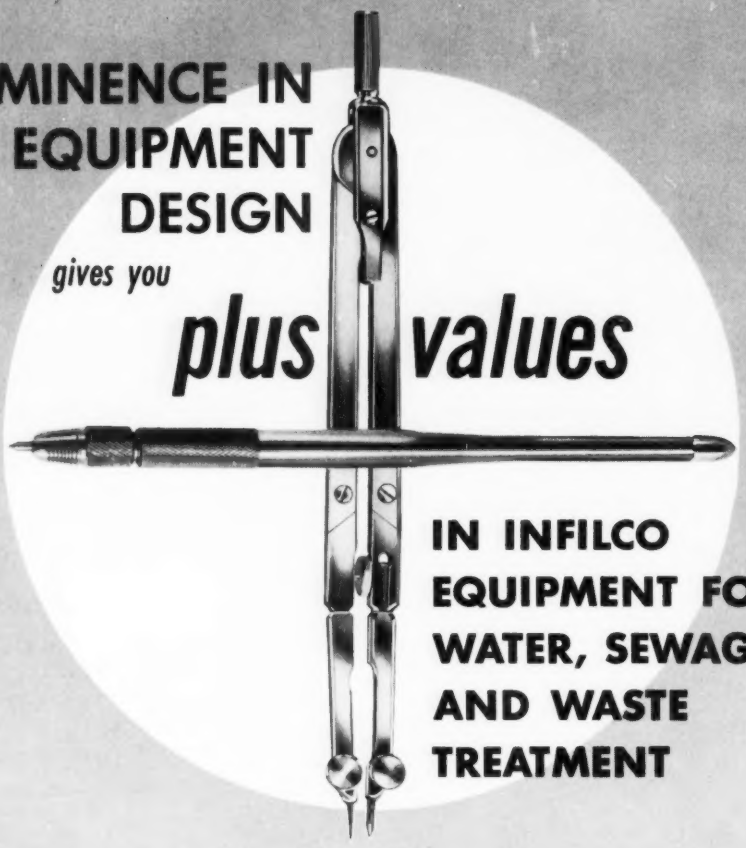
LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 2805 Allen Street • Dallas, Texas • Riverside 7-5814

EMINENCE IN EQUIPMENT DESIGN

gives you

plus values



IN INFILCO EQUIPMENT FOR WATER, SEWAGE AND WASTE TREATMENT

Here are examples of INFILCO PLUS VALUES...

More Production in Less Space...Compact designs, exemplified by the ACCELATOR® treating plants, save up to 80% of the space required by "conventional" methods.

Savings in Installed Cost... Because of minimum space requirements, many INFILCO units can be installed for much less, resulting in substantial savings in the cost of the complete installation.

Low Maintenance... Rugged construction, elimination of underwater bearings, and custom design for each application result in long equipment life with very little downtime for maintenance and repair.

Chemical Savings...Recirculation and other techniques frequently reduce chemical consumption to the minimum laboratory requirements.

Reliability...Conservative design with liberal safety factors for peak demands or unusual conditions afford full design capacity and trouble-free operation.

Proper Treatment... The experience of over 60 years, specializing in all types of water and waste treatment, assures you of the best for your requirements.

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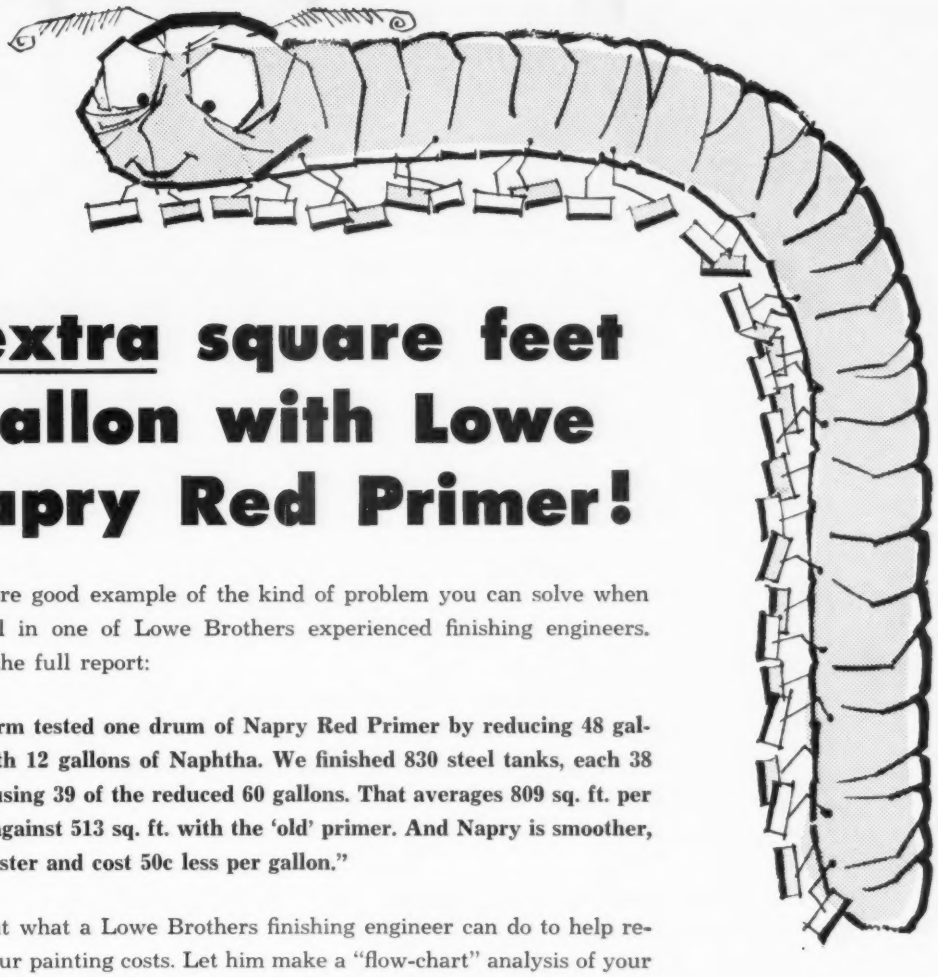
These and other important plus values are available from INFILCO—the world's leading manufacturer of water, sewage, and waste treating equipment.



296 extra square feet per gallon with Lowe Napry Red Primer!

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"This firm tested one drum of Napry Red Primer by reducing 48 gallons with 12 gallons of Naphtha. We finished 830 steel tanks, each 38 sq. ft., using 39 of the reduced 60 gallons. That averages 809 sq. ft. per gallon against 513 sq. ft. with the 'old' primer. And Napry is smoother, dried faster and cost 50c less per gallon."

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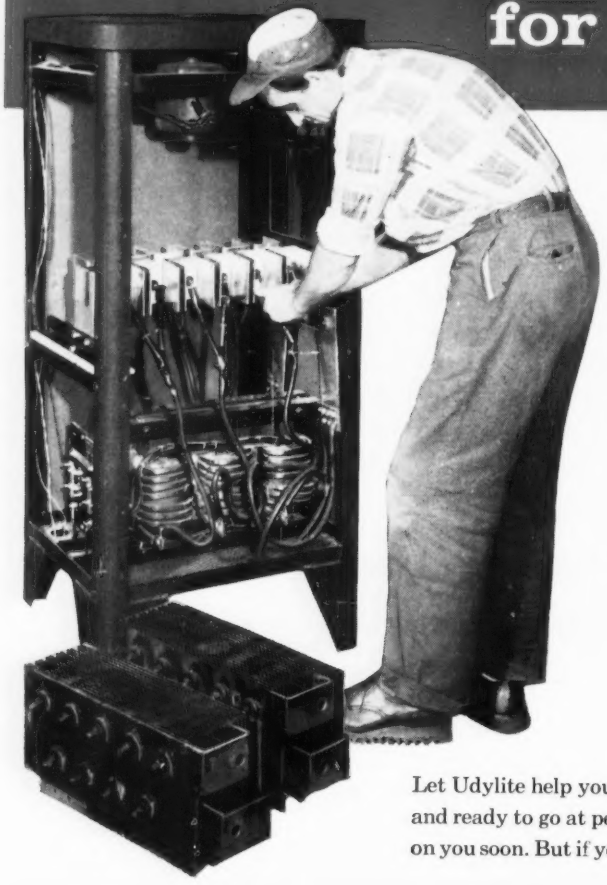
for old rectifiers



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NIALK® TRICHLOR FOR BOTH FLUSHING AND VAPOR DEGREASING

Use just one grade of trichlor to flush missile and rocket parts and for vapor degreasing

The *metal degreasing grade* of Nialk trichlorethylene meets government and industry specifications for flushing missile and rocket components.

Its residue is a low 0.0005%. It also meets standard impact sensitivity requirements.

Cut your inventory The time and money savings of this new development are obvious. In just one area—your inventory—you can make substantial savings.

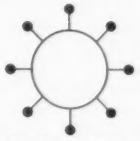
Eliminate mistakes There's no chance of picking the wrong drum now that you need only one grade of trichlor for both flushing and vapor degreasing.

No disposal problems Take the Nialk trichlor you use for flushing and in most cases you can use it in your vapor degreasing operation without distilling.

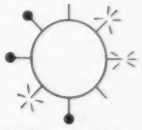
Data sheet For more information on this standard grade of Nialk trichlor, write for data sheet No. 814.

Remember—*only Nialk trichlor has* **psp.**

DOES YOUR SOLVENT SOUR?

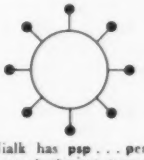


1. Trichlor is protected by stabilizer against heat, air, light, moisture, acids, and active metals.



2. Ordinary stabilizers wear out during use, making it necessary to titrate and add fresh stabilizer.

3. A sour solvent can even stain metals instead of cleaning them; affects bath operation, too.



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Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

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Pretax earnings average 6.4% or $6,400 on each $100,000 of product you sell after raw materials, sales expenses, overhead and miscellaneous are deducted.*

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Columbia-Southern is a foremost name in degreasing knowledge and experience, product quality, cost-saving operation. Our Technical Service specialists will be glad to examine your degreasing process and recommend ways in which you can effect savings.

SO, WHY WAIT?

If a Columbia-Southern representative has not yet reviewed your degreasing operation, his visit in the near future will more than likely save you money. So, why wait? Write today to "Trichlor" at our Pittsburgh address.

*Based on Manufacturing Corporation Statistics for the first half of 1958.

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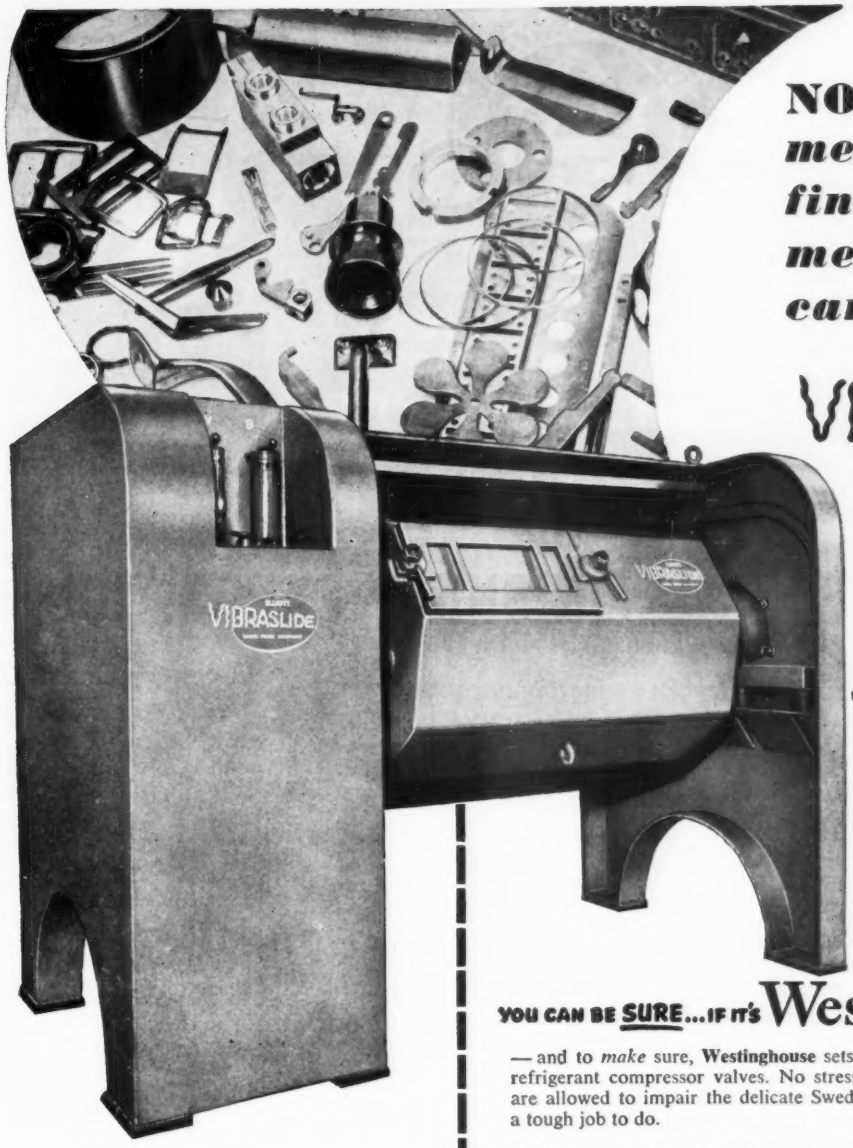

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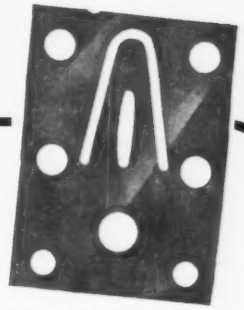

Delicate Swedish steel reed, 10/1000" thick being finished, by Westinghouse, in the Vibraslide.

YOU CAN BE SURE...IF IT'S Westinghouse

— and to *make* sure, **Westinghouse** sets highest quality standards for refrigerant compressor valves. No stress points likely to shorten life are allowed to impair the delicate Swedish steel reeds that have such a tough job to do.

At the Columbus, Ohio, **Westinghouse** refrigerator plant, a VIBRASLIDE method deburrs, forms radii, and removes shear marks, even in the hard-to-reach areas of these precision stampings.

Quality and uniformity are better than with any other method — manual or mechanical — and costs are down.

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If your product demands precision finishing that other methods haven't achieved, VIBRASLIDE's new force-rotational vibration — may mean improved quality and lower cost for you.

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The finishing experts will all be under one roof next June. In Detroit, at the Detroit Artillery Armory, from June 15 to 19, at the Fifth Industrial Finishing Exposition!

Take your problems to them. Get expert help . . . at the largest display of finishing equipment, materials and processes ever assembled under one roof.

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If you want more information on the Fifth Industrial Finishing Exposition *now*, ask the exposition chairman: • • • • • • • • • •

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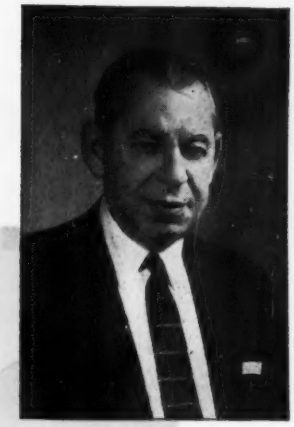


A Timely Message on
Tenacity of the individual
by Ben P. Sax

Chairman of the Board, *American Buff Company*

Dogged perseverance, backed by belief based on knowledge, has made a lot of little fellows rich, in the face of discouragement by the experts. One of the most recent illustrations is the triumph of a Kentucky farmer.

Knowing the terrain and the underlying oil supply, farmer Turner, a self-taught oil expert, persuaded a gas company to drill for oil in "a poor man's field" in easy reach of water-well equipment (and its comparatively small well cost). They struck oil. But, faced with high costs of separating it from the salt-water-and-oil mixture, they sold out in disgust to Turner, who had obtained the leases.

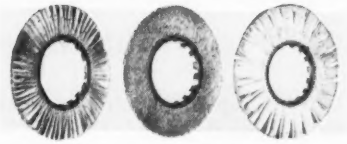
"Tenacious Turner" still believed it could be done — and easily — although geologists and oil experts had always insisted it could not be commercially economical. With powerful pumps, he drew down the water level fast, let the rock-trapped oil flow into the bore. In one day, Turner's method now produces as much oil as the company's efforts produced in an entire month.

The balance of the oil boom story: the poor farmers on poor land are now rich owners on easy street. Just one more example of the spark that led pioneers not only to settle and build our land, but also to develop the industrial marvels which keep our standards of living always on the rise.

Sincerely,

Ben P. Sax

"For the job that's TOUGH—use an AMERICAN BUFF"



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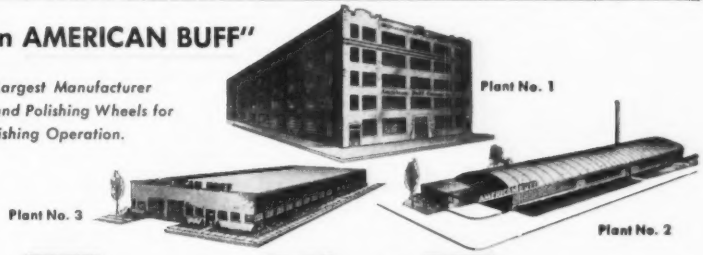
World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation.



American Buff Company
2414 S. La Salle Street Chicago 16, Illinois

AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE

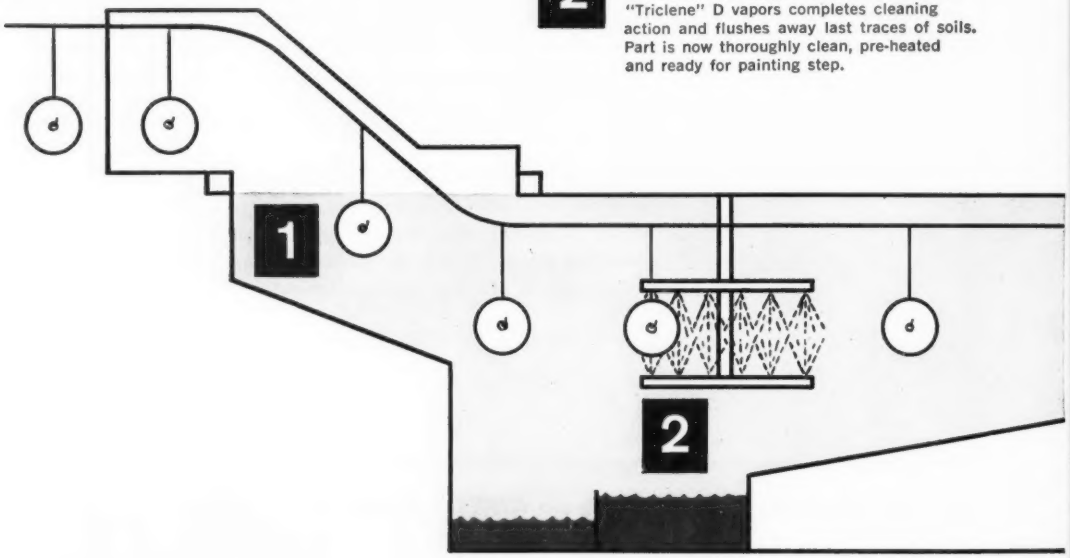
Du Pont announces a new process . . .

Vapor degreasing and in one compact unit—with

HOW IT WORKS

1 Greasy and soiled pulley wheel (above) enters degreasing section of unit (No. 1 below) after prior fabricating steps. Cleaning action begins as "Triclene" D trichlorethylene vapors condense on cold part.

2 Mechanical action of spray rinse (No. 2 below) accelerates cleaning. A final rinse in pure "Triclene" D vapors completes cleaning action and flushes away last traces of soils. Part is now thoroughly clean, pre-heated and ready for painting step.



Here are the advantages . . .

SAFE: New process uses paints thinned with non-flammable "Triclene" D solvent. Fire and explosion hazard virtually eliminated!

CUTS COSTS: Solvent, overspray and excess paint are fully recovered—drip loss is eliminated. Integrated cleaning and painting with "Triclene" D trichlorethylene cuts labor and utility costs.

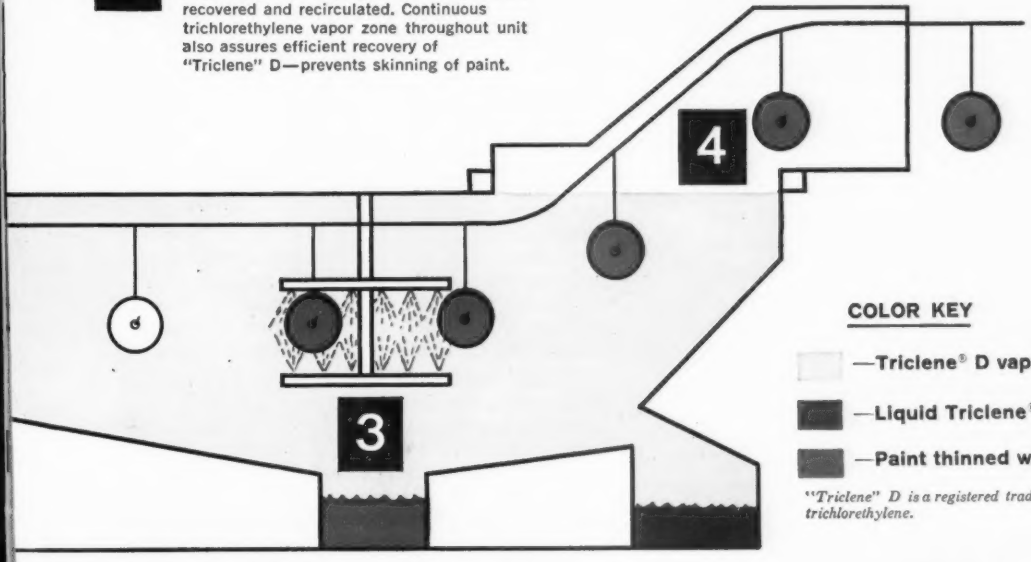
ONE COMPACT UNIT: Simplified equipment saves floor space and reduces finishing time. Unit can be easily adapted to fit in with other production steps both before and after cleaning/painting.

LOW INVESTMENT: No drip pans or spray booths needed. Drying ovens can be eliminated or requirements minimized.

nonflammable painting Triclene® D trichlorethylene

3 Nonflammable paint thinned with "Triclene" D is "flowed" on the part (No. 3 below). Overspray and excess paint are recovered and recirculated. Continuous trichlorethylene vapor zone throughout unit also assures efficient recovery of "Triclene" D—prevents skinning of paint.

4 When lacquer type paints are used, parts emerge from unit (No. 4 below) completely dry and ready for final assembly or packaging. Where curing paints are used, baking can be attained with minimum time and equipment requirements.



COLOR KEY

—Triclene® D vapor zone

—Liquid Triclene® D

—Paint thinned with Triclene® D

"Triclene" D is a registered trademark for Du Pont trichlorethylene.

Technical Report available . . .

Du Pont has prepared a Technical Report describing its new process for integrated cleaning and painting. Included are cost comparisons to help you determine probable cost savings. Get a copy of this Report from your Du Pont representative or your distributor of "Triclene" D trichlorethylene. You can also write to Du Pont, Electrochemicals Dept., Wilmington, Del.

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Nickel Pentrate is the only one-bath black oxide finishing salt in the market containing nickel. Fully covered by U. S. and foreign patents, it is readily available to improve the quality of your black oxide finishing of steel and at the same time hold down production costs.

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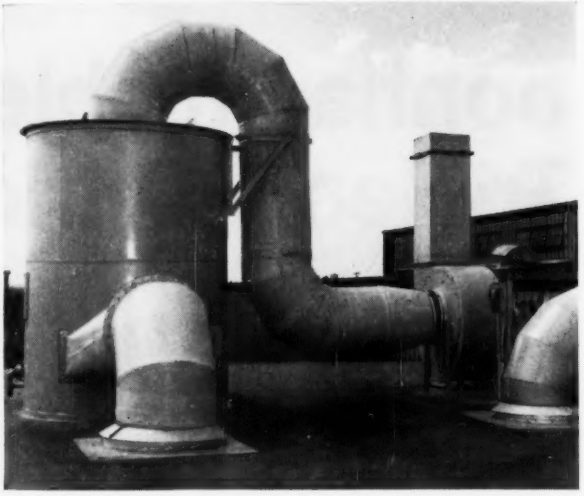

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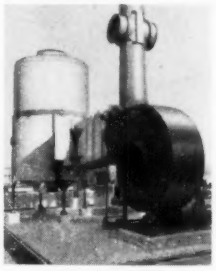
Widely used and proven in service, Heil Fume Scrubbers are built in several designs, and in standard sizes from 1,000 to 30,000 C.F.M., thus speeding delivery and minimizing your engineering costs.

Heil Scrubbers are moderately priced and operate with low pressure drop, minimizing fan requirements. Water can be recirculated; reducing the amounts of new makeup water required. There are no moving parts, nothing to wear out. Completely acid and alkaline proof construction assures maximum service life. Those built of Heil Rigidon (reinforced plastic) are light in weight, and usually can be installed on roofs without the added costs of reinforcing beams and trusses.

Let the Heil Corrosion Engineers, with 29 years experience, analyze your requirements, recommend the size and type of standard or special scrubber you need; also the auxiliary collecting hoods, ducts, fans and stacks, so that you have an efficient, dependable, completely corrosion-free system.



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LEA PLASTI-BRADE

...a liquid abrasive composition with grits ranging from 80 to 320

LEA PLASTI-GLUE

...a flexible liquid adhesive for setting up polishing wheels in a wide range of grit sizes

The marked success of LEA LIQUABRADE in liquid buffing operations led our technical staff straight into the important field of polishing and burring with liquid abrasive compositions.

LEA PLASTI-BRADE and LEA PLASTI-GLUE, latest of such developments, are both designed for use with a wide range of grits for flexible polishing operations. PLASTI-BRADE is a non-flammable, stable, liquid abrasive polishing composition in combination with grits ranging from 80 to 320. PLASTI-GLUE, also non-flammable and stable, is a liquid adhesive for setting up polishing wheels in various grit sizes. Both liquids can be sprayed, brushed or rolled. Both come in 30 to 55 gallon drums, 5 gallon pails, or gallon cans. Place a trial order today for enough to make a thorough test. If you want our recommendation as to proper grit sizes, etc., write in detail about the kind of work involved, operational steps, and end-finish desired.

Have you tried LEAROK...compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations. Write today for technical data on the Lea Finishing Products.

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Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
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AURO GLO*

...a new gold process

A LEA-RONAL ANNOUNCEMENT

If you are plating gold—particularly for industrial purposes in connection with electronics or electrical parts where physical characteristics are of extreme importance—investigate the new but well-proved Lea-Ronal Auro Glo Process. It offers:

- **bright deposits for all thicknesses of plate. Auro Glo deposits do not merely duplicate the brightness of the metal as do conventional bright cyanide golds but rather 'build' brightness.**
- **wide bright plating range (0-50ASF) permitting trouble-free rapid deposits.**
- **24 Karat or alloy deposits.**
- **3 to 4 times greater hardness yet with far more ductility than deposits from conventional cyanide bright gold.**
- **heavy build up with electro-formed deposits that are mechanically workable.**
- **greater economy because through exceptional hardness and wear resistance, thinner deposits are permissible.**
- **dense, porosity-free deposits, passing all tests of major electronics parts manufacturing.**
- **no spotting out or bleeding out even at elevated temperatures or prolonged storage.**
- **exceptionally stable bath; simple to use.**

And for those interested in gold for decorative use, Auro Glo offers for the first time Hamilton Shades in a gold for heavy deposits.

As with all Lea-Ronal developments, Auro Glo has been production-tested for well over a year prior to this announcement. It is the superior gold plating formulation. If you electroplate gold, test the Auro Glo process.

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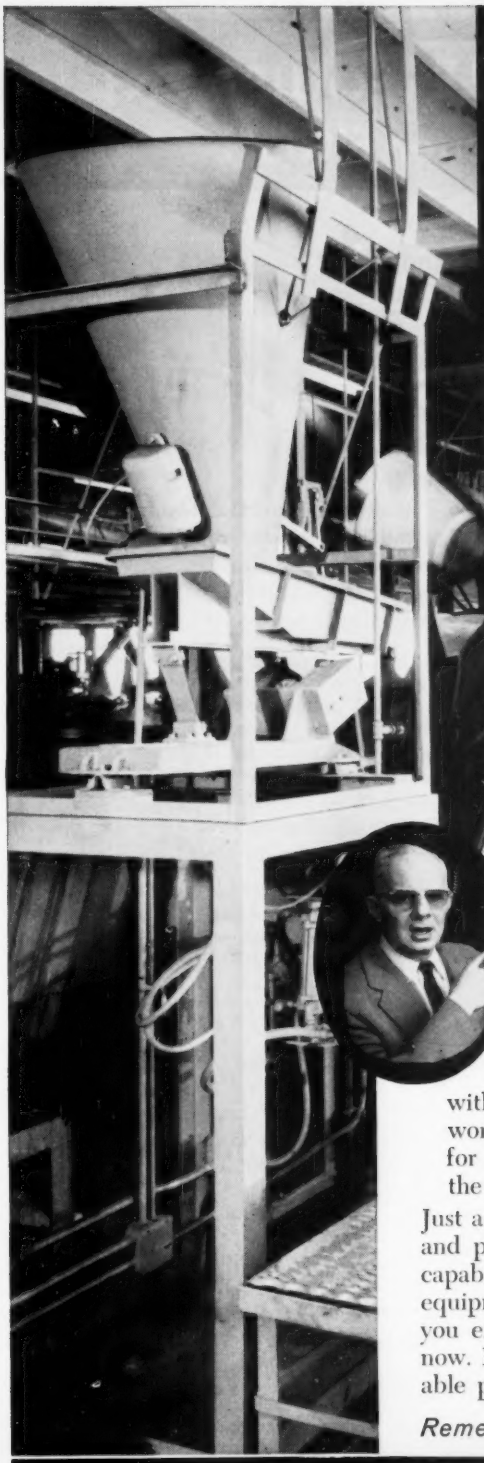

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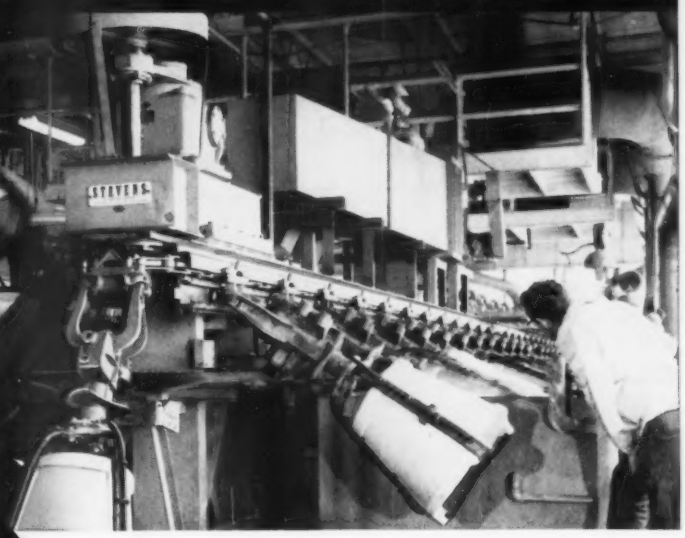
AUTOMATIC PLATING MACHINES CUT COSTS AND INCREASE EFFICIENCY—*IMPRESSIVELY*

FOR NATIONAL LOCK COMPANY



Read what Paul Repka, assistant plant engineer for National Lock Co., Rockford, Ill., says about his company's Stevens automatic machines:

> "When we installed our battery of three Stevens Automatic Plating Machines in 1957, we were rewarded by an immediate increase in efficiency and an accompanying reduction in plating costs. The machines keep up with demanding production schedules easily. And their noteworthy savings in material and labor costs have proved to us that for high-volume, low-cost metal finishing, Stevens Automatic is the right answer."

Just as Mr. Repka did, an ever-growing number of metal-finishing and plating executives are learning of the increased production capabilities and cost-cutting abilities of Stevens automatic plating equipment. If your present method of plating isn't giving you all you expect of it, contact your local Stevens sales representative now. Let him show you the automatic Stevens way to more profitable plating and processing.

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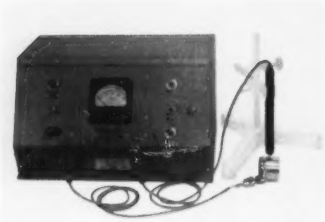
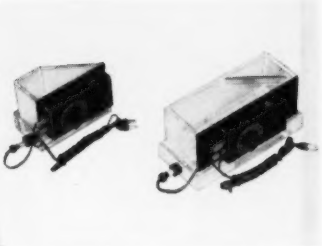


A dielectric thickness tester for anodic coatings on aluminum as specified in ASTM B110-45. Essential for every aluminum anodizing plant.

LUCITE MODEL "WT" 267 ml. and "WT" 1000 ml. HULL CELLS



With quartz heater and built-in thermostatic control; for plating baths at elevated temperatures. Also available without thermostat and heater in Lucite, Molded Polyethylene and Porcelain.

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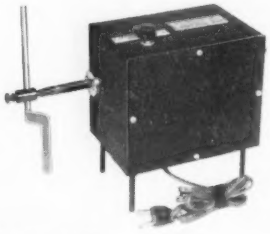
Has unusual refinements, accuracy and simplicity of operation for laboratory or bench plating. Output: 30 amps. D.C., at 13 volts for general use, or 6 amps. D.C., at 18 volts for Hull Cell use. Full wave rectification with output filtered to give 3% or less ripple; powerstat voltage control from zero to full voltage; dual ammeter; voltmeter.

NEW MODEL HANGING HULL CELL

Catches plating troubles at the source by spot checks. Just suspend the cell on the cathode busbar (as you hang a rack of work). Adaptable to any type of still or automatic plating.

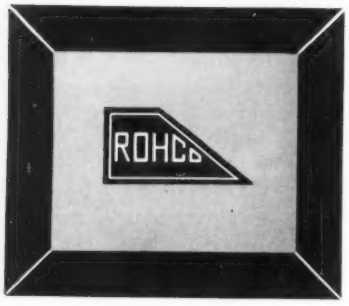
THREE SPEED HULL CELL AGITATOR



Simulates cathode rod agitation in Hull Cell by means of reciprocating motion of its paddle.

SAMPLING TUBE

Durable lucite. Designed for perfect sampling of plating baths without mess or fuss.



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Continuous rotation from one operation to the next
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The motor drive to the countershaft is through bevel gears operating in a gear case and permanently lubricated. Standard R.P.M. of the cylinder is 5; however, other speeds are obtainable at no extra cost. Hanger arms completely covered with fused plastisol.

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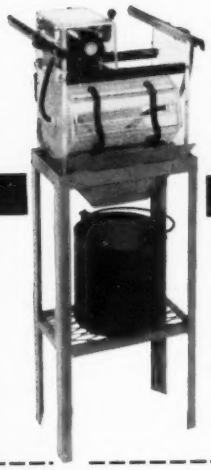
"Motor Drive from Side of Tank Always Available."



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STUTZ *Portable Plating Barrels*

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x18" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

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- Load/Unload Stand for convenient and fast handling of work load.

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Q: "Briefly, how does ABBEY-Matic achieve the heretofore 'impossible' functions and flexibility referred to in your previous 'question and answer' ad?"

A: The previous limitations of process automation were overcome in one stroke by the revolutionary ABBEY-Matic (patented) basic principles of independent carrier and station signaling, actuating and controls which for the first time removed the strangle hold of mechanical synchronization and fixed-sequence common to conventional "automatics." (See Bulletin for details.)

Q: "Can I automate several finishes from one cleaning cycle?"

A: Yes, for the first time, this is economical and practical. ABBEY-Matic eliminates the cumbersome and costly arrangements required by conventional machines.

Q: "Can I also vary the cleaning cycle for different materials?"

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Q: "Can I change or add a cycle easily?"

A: Yes, for the first time! ABBEY-Matic standard components are readily supplied, easily applied. No complications.

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Q: "How are barrels electrified to coordinate with the System?"

A: ABBEY-Matic motorized barrels are self-contained and pick up power for rotating and plating currents from the System at contact points located for optimum results — entering solutions, leaving solutions, through dryers, etc. Other motivating devices are similarly electrified, eliminating trailing cables, engaged wires, trolleys, etc.

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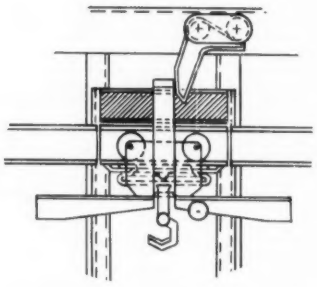

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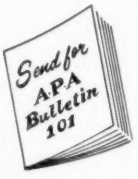

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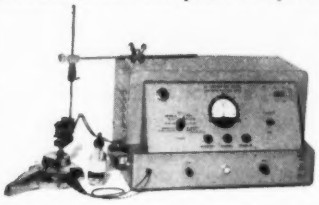

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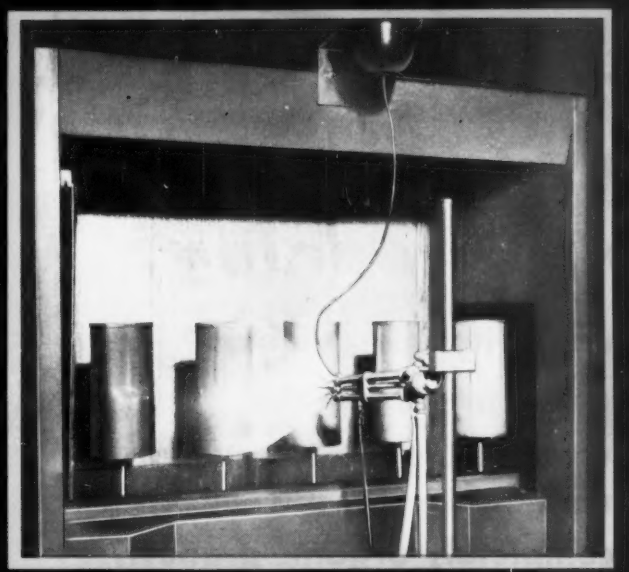

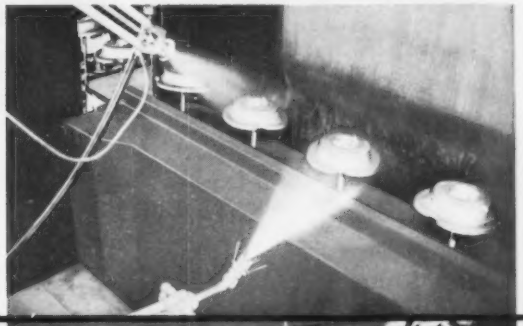

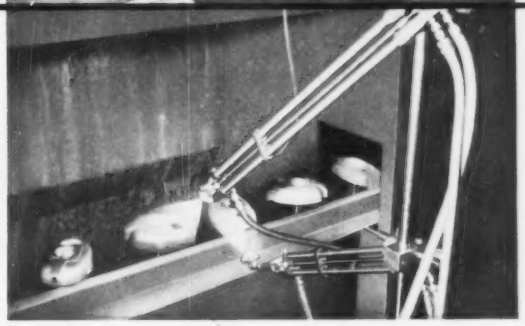

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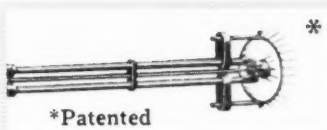

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FEBRUARY, 1959 Volume 57 No. 2

FEATURES

Editorial — Paying the Price for Quality 47

Composition and Application of Anodes 48
By D. J. Fishlock

Abrasive Sheets and Belts 52
By Lester F. Spencer

Evaluation of Paint Spray Booths 58
By J. Arthur Weed

Sulfate Determination in Chromium Plating Solutions 59
By Saburo Konishi

Plating Waste Disposal 61
By Walter Mikos and Alfons Szkudlapski

Electroless Nickel Plating of Carbon 64
By Harry J. West

Science for the Coatings Technologist 65
By E. S. Beck

Which Rectifier for Electroplating — Silicon or Germanium? 69
By J. T. Cataldo

Science for Electroplaters — Part XLIV 71
By L. Serota

DEPARTMENTS

Shop Problems 74
Patents 76
Abstracts 80
Recent Developments 84
Obituary 93
Business Items 94
Manufacturers' Literature 107
News from California 109
Associations and Societies 110

Published Monthly By
Metals and Plastics Publications, Inc.
Established in 1903 as Metal Industry by Palmer H. Langdon 1868-1935.
381 Broadway, Westwood, N. J.
NOrth 4-1530

Joan Trumbour Wiarda, *President and Advertising Director;* Palmer H. Langdon, *Publisher;* John E. Trumbour, *Business Manager;* Nathaniel Hall, *Technical Editor;* Daniel A. Marino, *Ass't. Tech. Editor;* Fred A. Herr, *Pacific Coast Editor;* Inez Oquendo, *Equipment & News Editor;* Elizabeth Meyers, *Circulation Manager;* John Ashcraft, *European Representative.*

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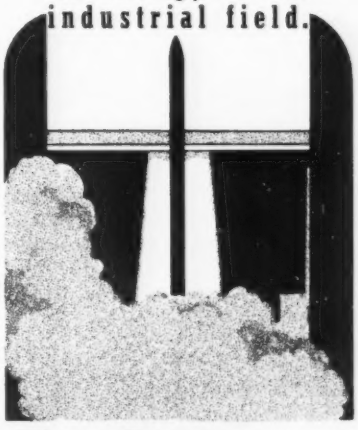

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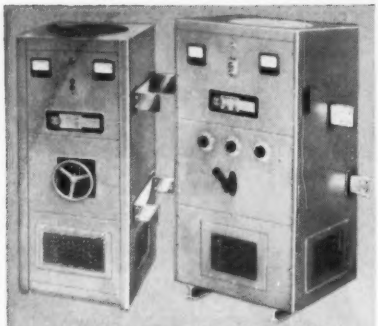

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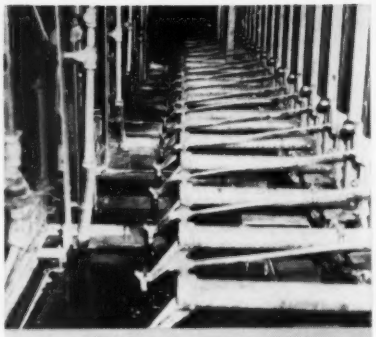

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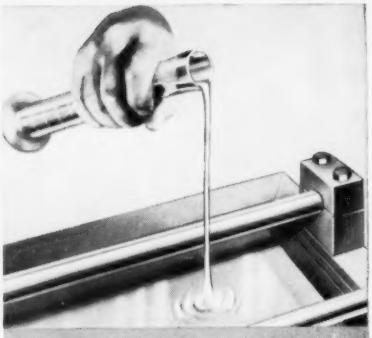

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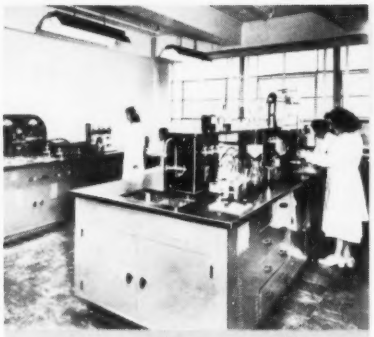

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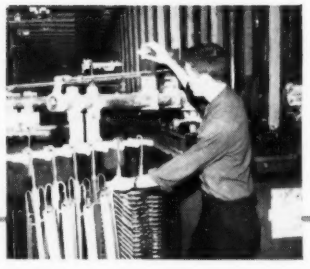

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ESTABLISHED 1903 VOLUME 57 • NUMBER 2 • FEBRUARY, 1958

PAYING THE PRICE FOR QUALITY

Remember the old pre-war days, when the plating on your car still looked good at trade-in time? When you were able to hammer out a dented fender without the finish peeling off in sheets? Reading the comments in the nation's press about certain indications that the recession may well be a revolt against paying high prices for inferior quality, we are inclined to agree even after making due allowances for assembly and service difficulties introduced by the complexity of modern mechanical consumer products. But, what has happened to pride in workmanship? What has happened to quality, and how can it be improved?

The mechanic's pride in a job well done appears to have vanished in this era of mass production, where responsibility for the finished product is so widely distributed that it suffers from extreme attenuation. However, with the introduction of so many hitherto unknown or little-used resins and solvents having very desirable properties, it would seem, at least, that the finisher who pays for high quality materials should end up with a quality finish. Unfortunately, in too many instances this does not necessarily follow, either because the finish doesn't happen to be the right one or because it isn't applied properly. When this occurs, it is due, of course, to the unfamiliarity of the finish salesman with the customer's requirements and with the unfamiliarity of the purchaser with the coating material and its method of application.

Gone are the days when thinner was added to a lacquer until testing between thumb and forefinger indicated a suitable spraying or dipping viscosity; when an oven only had to be *hot* because finishes were only force dried, not polymerized. A finisher's background information these days includes the general characteristics of alkyds, epoxies, phenolics, acrylics, and vinyls, but the combination of ingredients for a suitable finish is properly within the province of the formulator. Therefore, the lacquer salesman must be consulted and acquainted with the requirements of the finish, so that he and the technical staff who back him up can make intelligent recommendations. Application instructions must be followed implicitly. Viscosity is tested, not guessed at. Air pressure when spraying, withdrawal rate when dipping, are not subject to speculation. And, baking schedules do not permit of interpolation if the best film properties are to be obtained. Sometimes, a longer bake at a lower temperature is as effective as a short bake at high temperature but, have you ever tried baking a vinyl plastisol at 250°F? Don't gamble, but check with the supplier first!

There is no sense to buying quality materials in order to produce a quality finish, then throwing away all the advantages by neglecting to apply it properly. When the finish supplier suggests what to use and how to use it, don't depend on your own judgment — it isn't necessary.

Nathaniel Hall

Composition and Application of Anodes

By D. J. Fishlock, *Bath, England*

EVEN after over a century of commercial electroplating many platers fail to appreciate the paramount importance of the anodes in any electroplating process. Second only to faulty pretreatment, though, malfunctioning of the anodes is responsible for more plating troubles than any other factor. Basically the anode's function is to provide a path for the current out of the solution (from the Greek *anodos* meaning way up). Usually, too, it replenishes the solution's metal ions while it may promote certain salutary oxidation reactions at its surface. In order successfully to fulfill these functions it must display certain characteristics, chief of which are:—

(1) *Free and uniform dissolution* at an efficiency closely corresponding to or just above that of the cathode over a wide range of plating conditions, with no tendency to disintegrate, polarize, or passivate.

(2) *High conductivity* and, therefore, little loss of power through the anode circuit.

(3) *High purity* and, thus, no tendency to contaminate the solution with soluble or insoluble impurities.

The conditions in (1) are achieved only by selection of the type of anode, with particular regard to its method of manufacture and heat-treatment, but also to its size and shape, most appropriate to the process concerned. Heat-treatment can markedly influence solubility, a factor which has become increasingly appreciated in the past few years. Metal shortages and the need to minimize anode scrap, together with abortive attempts to use inferior grade materials, have focused attention on this point.

Cast anodes are usually formed in chill or permanent molds and tend to be coarse structured and freely corrodible.[1] The coarse structure does tend to allow intergranular attack and the partial disintegration of some anodes but, by yielding a relatively coarsely divided sludge, such anodes often present less trouble in bagging. The ball and elliptical anodes are also cast, and prove especially popular since there is virtually no scrap loss. These are used, in the case of cyanide solutions, in steel wire cages — preferably of clipped rather than welded construction to avoid anodic weld corrosion; the steel plays a further vital role here, dealt with later.

Rolled and extruded anodes are of much finer grain size and often have improved corroding characteristics, especially in the more active solutions. They can be produced in considerable lengths, although extruded anodes are sometimes chopped into small sections for use in cages. Electrolytic anodes, although the highest in purity, have limitations in that their structure may not be uniform and they sometimes tend to polarize easily. In all cases, very critical heat-treatment and annealing is essential to their successful functioning.

Anode shape has attracted much attention since this can directly influence its surface area and, through this, the uniformity of corrosion, the final scrap loss, the dispersal of gas from its surface and the tendency to polarize. Oval and circular section anodes, sometimes with ribs, grooves or a sand-blasted surface are displacing many of the flat smooth plates and strips of the past, while the ribbed section has been found very economical with the softer metals, notably silver and lead. A heavily ribbed cast silver anode has been effective in an inclined barrel, a plating unit in which the anode area is normally remarkably exiguous.

Insofar as composition is concerned, the tendency today is towards extreme purity in most anodes, this requiring the greatest care in their production. Sometimes small additions, such as carbon and silicon in depolarized nickel anodes, are beneficial, while other small alloying additions may replenish an essential bath constituent. Phosphorus in certain copper anodes[2] and cobalt in some nickel anodes are other examples. Usually, though, trace elements both metallic and otherwise tend to contaminate the solution or form anode slimes while, very often, their elimination improves the conductivity and the corrosion characteristics of the anode.

Anode conductivity can also be of significance since not only does an appreciable resistance mean a loss of power but it can influence the plate's distribution. This factor should be considered in determining the optimum length of an anode; it is normally a few inches shorter than the cathode but, for close conformity to a thickness specification, the optimum length must be determined empirically. With inert anodes the resistivity can sometimes be used to closely control, for example, the amount of current reaching the lower end of a tube being plated internally; this is by virtue of the voltage drop along the anode's length.

Anode hooks are a frequent cause of contact trouble.

These are advisedly of square section so that they give a line rather than a point contact, while the high pressure on the sharp contact edge of the hook will pierce any films on the anode bar. More elaborate hooks are sometimes provided with spring or screw devices to improve the contact pressure. Hooks require to be very firmly affixed to the anode and, preferably, the joint should be sealed with a rubber or plastic cap, or lead seal if permissible, to prevent the ingress of plating solution.

Alloy Anodes

It is imperative that, in any development work on alloy plating, the earliest consideration be given to the anodes; many a promising alloy process has failed completely in production owing to the difficulty of persuading the anodes to replenish the solution at the same rate as it is depleted of metal ions. There are four anode systems for alloy plating currently in use,[3] soluble alloy anodes, soluble but individual constituent anodes, inert anodes, and combinations of the first two and/or the third system.

Most convenient, of course, are the alloy anodes, although the anode constituents are not necessarily present in the same ratio as in the final deposit. In brass plating, anodes of the same ratio can be used, and are available with from 20 to 35% zinc. In tin-nickel plating, however, anodes containing 35% Ni, as in the deposit, consist of two inter-metallic compounds, Ni_3Sn_2 and Ni_3Sn_4, of which the former dissolves preferentially; anodes of 72 to 73% Sn, i.e. entirely of Ni_3Sn_4, or else separate anodes, are therefore used.[4] Alloy anodes are preferably in a single phase solid solution since twin phases usually have different rates of dissolution at a given potential.[3] Both mechanical mixtures and intermetallic compounds find application, however. There is sometimes difficulty in obtaining anodes of the required composition by normal metallurgical techniques, but this can always be overcome by producing them electrolytically if the expense is justified.

Failing the availability of a suitable alloy, however, separate anodes are needed. With careful attention to the solution and operating conditions these can often be operated from a single anode rod or, if the difference in anode potential is slight (e.g. 0.1 v. in tin-nickel solutions), a small fixed resistor can be incorporated in the hook of the anode (in this case tin). Separate or dual anode circuits are advisable if the difference in potential is appreciable. The rate of metal dissolving from each set of anodes can then be adjusted closely by means of the current density on each, the potential difference between the two sets, and between each set and the cathode. Each anode bar should be supplied and metered independently. Separate anodes may also need independent attention in other respects; for instance, in most tin alloy plating the tin anodes must be removed when not in use to prevent the formation of stannite but, in tin-nickel plating when separate anodes are used, the nickel anodes should remain in the solution to help prevent oxidation of Sn^{2+} to Sn^{4+}.

Particularly if the proportion of one constituent in the deposit is small, it can be replenished by chemical additions. Salts are more costly than anodes, but this may be offset by the convenience, as in some cobalt bright nickel and molybdenum bright zinc processes. Inert anodes have also been used occasionally when soluble anodes prove entirely impracticable, but the control difficulties can rarely justify their use in continuous production. The system has been used for depositing ternary alloys such as Sn:Cu:Zn and Sn:Cu:Co.

Copper Anodes

The raw material for all quality copper anodes is electrolytically refined copper of 99.98% purity or better. This may be used unmodified as an anode, but requires bagging, while brittleness of the deposit and anode loss due to partial disintegration are not uncommon occurrences.

Cast anodes are produced by melting and pouring electrolytic copper, a procedure which is highly critical if the introduction of cuprous oxide is to be avoided;[5] this constituent causes the disintegration of the anode. It can be avoided by deoxidizing the melt with phosphorus, which produces an anode containing about 0.02 to 0.03% P and negligible amounts of oxygen.[6] Such anodes need no bags and corrode extremely uniformly. Another type of extreme purity anode is the oxygen-free high conductivity (OFHC) anode, which

TABLE 1

Typical Analyses of Plating Anodes, % Impurities

	As	*Bi*	*S*	*Cu*	*Fe*	*O*	*Pb*	*S*	*Si*	*Others*
Cadmium	0.005	—	—	—	0.1000	—	—	—	Traces	99.90% Cd
Nickel										
cast C	—	—	0.21	Trace	0.10	—	—	—	0.05	99.6 Ni, 0.04 Mg.
rolled C	—	—	0.25	0.02	0.07	—	—	0.01	0.25	99.3 Ni
cast depol.	—	—	0.01	0.01	0.20	0.2	—	0.01	0.10	99.6 Ni
rolled depol.	—	—	0.01	0.05	0.08	0.25	—	0.005	0.02	99.5 Ni, 0.01 Al, 0.005 Mn.
electrolytic	—	—	trace	0.03	0.04	—	—	trace	trace	99.95 Ni
Tin	0.014	0.002	—	0.004	0.007	—	0.015	0.003	—	0.007 Sb, 99.94 Sn
Zinc	—	—	—	0.01	0.01	—	0.08	—	—	99.81 Zn, 0.08 Cd
Copper E.T.P.	0.0006	0.0001	—	99.956	0.001	0.034	0.001	0.0015	—	0.0013 Ag, 0.0014 Ni
fire refined	0.005	0.002	—	99.781	0.005	0.070	0.010	0.003	—	0.006 Ag, 0.09 Ni
OFHC	0.0003	0.0001	—	99.994	0.0005	nil	0.0006	0.0012	—	0.001 Ag, 0.0006 Ni

is produced by a patented sequence including melting in a reducing atmosphere in an electric induction furnace. This is above 99.99% pure and provides cast anodes for use in both acid and cyanide baths without bags; corrosion is extremely uniform and the scrap loss negligible. Cast copper anodes perform most satisfactorily in acid electrolytes, while the deoxidized cast types are particularly valuable for heavy deposition and in electroforming. Rolled and extruded electrolytic anodes are preferred for cyanide electrolytes, these having a denser, finer structure. They are available in very large sizes.

There is no reasonable limit to the current density for copper anodes in acid baths, but it is customary to use an anode area roughly equal to that of the cathode; in cyanide solutions, however, the anode area should be about double that of the cathode, while a limit of 20 to 30 amp./ft.^{2} must be observed. Excessive anode c.d.'s in cyanide solutions result in anode polarization due to the formation of a green slime which rapidly re-forms when removed unless the plating conditions are modified. Inert anodes of steel are often used to lower the anode efficiency in cyanide solutions. These do tend to dissolve and form ferrocyanide but it remains an arguable point whether, in small amounts, this has any adverse influence on the plating. Similarly, hard lead anodes may be used in acid electrolytes.

Nickel Anodes[7]

The cathode efficiency in nickel plating is high — about 95% — and, for satisfactory operation, that at the anode must approach 100%. Pure nickel, however, tends to passivate quickly, even when the electrolyte contains much chloride, and controlled additions of certain non-metals (carbon, silicon and oxygen) are essential if they are to function at commercially feasible current densities. The anode, nonetheless, must be extremely pure in other respects, since nickel solutions are very susceptible to metallic contamination, while the distribution of the additions and the structure of the anodes are highly critical. The writer recalls an experience in heavy nickel plating in which it was found that a handful of the many oval rolled depolarized anodes in use corroded irregularly, developing long undercut furrows down their length, and slimy black deposits; they degenerated into lumps of spongy

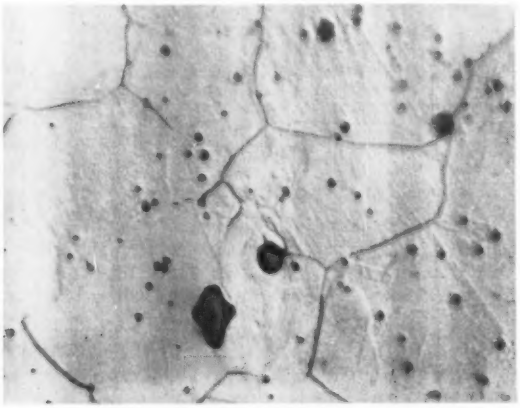

Fig. 1. Section through a depolarized nickel anode showing the uniform distribution of the nickel oxide addition. X600

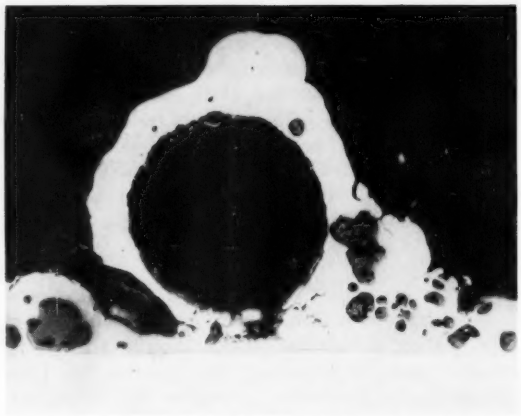

Fig. 2. Vertical section through a nodule formed around a black nickel oxide particle on a bright nickel deposit. X200

nickel long before their life should have ended. There was no difference analytically and, apparently, no difference structurally between good and bad anodes but the clear disparity in performance was attributed to some irregularity in the annealing.

Depolarized anodes are invariably rolled and contain about 0.25% oxygen as nickel oxide. This must be distributed uniformly throughout the anode (Fig. 1) and results in an anode capable of operating over a wide pH range in all types of solution and corroding extremely uniformly, with little scrap. Its corrosion is impaired, though, at low current densities, and not more than one per foot of anode bar is recommended while a good contact must be maintained.[8]

Carbon anodes, both cast and rolled, are for use in solutions below pH 4.5 and especially in the latest organic bright nickel baths. They contain carbon and silica, which form an adherent surface film to retain crystals and flakes of nickel as they become detached, until they dissolve. They are believed capable of retaining some 0.04% of their weight in this manner. Nickel anodes are invariably bagged in view of the economic importance of avoiding rough deposits, but one large plant has reported using unbagged carbon anodes.[9]

Electrolytic anodes are particularly pure and work well in low pH, high chloride solutions if correctly rolled and annealed.[10] The latter imparts a relatively coarse crystal size which assists bagging. They can also be used in cobalt-alloy solutions where a lower anode efficiency can be advantageous in some instances and, when broken into small pieces, in anode cages.

Anode Slimes

The anodes are prone to introduce a large proportion of the insoluble impurities suspended in a plating solution (Fig. 2, 3). With the greatly increasing use of bright plating solutions and an appreciation of the greater porosity of deposits from cloudy solutions, solution clarity is assuming considerable importance, while it proves much more satisfactory to eliminate the suspended matter at its source than to try to filter it out. In addition, heavy incrustations of slime soon polarize some anodes and reduce their conductivity.

Anode slimes result either from an unsatisfactory crystal structure, leading to excessive attack at the

grain boundaries and the dislodgement of crystals of metal, or from the impurity content of the anode. Unsatisfactory crystal structure, providing it is not due to incorrect heat-treatment, can be overcome by selection of anodes which have been worked and heat-treated in a manner most appropriate to the solution, current density, and temperature at which they are required to operate. Solutions of high dissolving power such as most strongly acidic and cyanide solutions are, generally speaking, most advisedly worked with the somewhat less soluble rolled or extruded anodes, while less active baths may usefully employ the more soluble cast anodes.

It is virtually impossible, however, to eliminate anode slimes — chiefly because of the non-metallic additions and inclusions needed to ensure uniform dissolution, e.g. NiO in depolarized nickel anodes. The usually adopted expedient, therefore, is to filter them out at the anode surface by bagging the anode. Ostensibly simple, this often proves far from easy but is successful in a few instances, in particular in near-neutral solutions. Nickel is the outstanding example and nickel anodes have been bagged successfully for many years.

Many fabrics have been used for bags but only a handful have proved their value; these include cotton drill, flannel, muslin (with or without paper interleaved), woven glass, blue African asbestos and a number of synthetic fibers. Monofilament woven Nylon is an especially versatile material: its tensile strength is double that of cotton fabrics while its non-absorptive feature prevents solution from siphoning above the solution level and causing salt incrustations. It is resistant to alkalis, most solvents except metacresols and similar compounds, and to most inorganic solutions except strong mineral and oxidizing acids. The synthetics and glass, although often remarkably inert, do suffer from the poorer retaining power of their single-filament fibers, but there exist hirsute short-staple polyvinyl chloride and Nylon fibers of superior attributes. The cost of the newer fibers also tends to be materially higher.

The bags may be in double thicknesses for the more exacting applications — although there is a definite limit to this and to the tightness of the weave if the

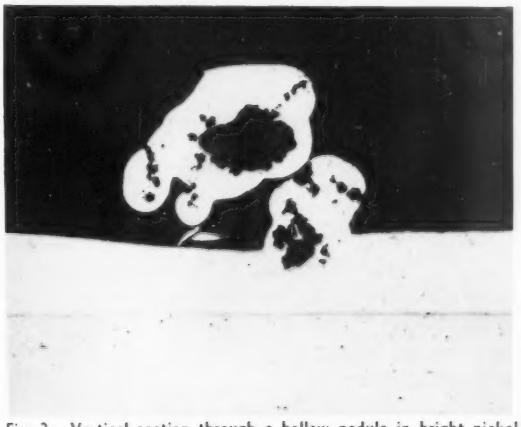

Fig. 3. Vertical section through a hollow nodule in bright nickel plating. The material responsible is believed to have been tiny nickel particles which have become dislodged from the anode. X250.

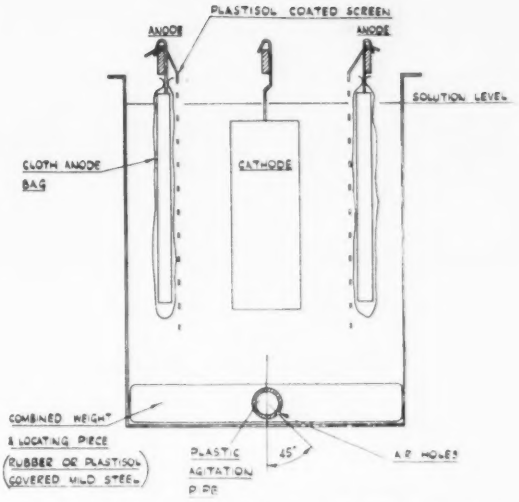

Fig. 4. Simple method of protecting anode bags in air-agitated solutions.

bag itself is not to polarize the anode by unduly retarding the migration of metal ions. It should be a few inches longer than the anode to allow slime to accumulate, preferably non-shrinking, and is normally tied for support to the anode hook. The mechanical wear-and-tear, especially in air-agitated solutions, is quite heavy and additional reinforcement at the bottom, and also at solution level where crystallized salts can accelerate deterioration, is often advisable. This can be supplied by extra thicknesses of fabric or by impregnating these regions with a resin or lacquer. The reinforcement has the additional advantage of retarding the corrosion of the anode at the points where it is normally excessive, thus aiding uniform dissolution. German practice favors large bags about 6 feet long to contain a number of nickel anodes, and it has been found that anode passivity risks are lessened by retaining the bag well away from the anodes; plastic cages may be used to achieve this. Another approach to the bagging of anodes is, of course, the auto-filter principle applied to certain nickel anodes with a carbon-silica content.

A simple but effective device has recently been developed to protect anode bags from ripping on sharp edges of the anode in vigorously air-agitated baths. This consists of a plastisol- or rubber-coated expanded metal screen hung from the anode bars[1] (Fig. 4).

Conscientiously maintained, an anode bag should last several times the life of the anode. Prior to being placed in use, however, it should be thoroughly rinsed in hot water, or better, in a solution of the same pH as the electrolyte; woven glass bags normally need degreasing to remove the spinning lubricant. It must be inspected frequently for holes and it is strongly recommended that the bag be removed weekly and washed. The latter is most efficiently achieved by turning it inside out and using a hose. At the same time, the anode should be scrubbed. This frequent inspection is advised because it is easy to neglect bagged anodes until they have become excessively dirty or small.

(*Continued on page 57*)

Abrasive Sheets and Belts

Basic Factors In Their Selection

By Lester F. Spencer, *Finishing Engineer, Waukesha, Wisconsin*

THERE has been a continued trend toward the use of abrasive discs, sheet and belting and, frequently, it has replaced other methods of grinding and polishing of metals. An excellent example would be the use of abrasive belts as a substitute for set-up wheels, offering advantages such as:—(a) an increase in the rate of metal removal; (b) a prior balancing of contact wheel that will result in maintenance of balance throughout its useful life; (c) the ability to change belts in a matter of seconds; and, (d) the realization of a smoother operation with less effort and burn in producing the more uniform finish.

Characteristics of Abrasive Minerals

There are five distinct and different minerals that are used in the manufacture of commercial coated abrasives, namely, (a) flint or quartz; (b) Turkish or American emery; (c) garnet; (d) aluminum oxide; and (e) silicon carbide. The characteristics of abrasives which are of most concern would include hardness, toughness and fracture type.

The *hardness* of an abrasive is a property that is difficult to define. However, it is frequently associated with the ability to penetrate the work surface to be ground or polished. In the event that the abrasive is not sufficiently hard to penetrate the surface of the metal, the end result would be a heating through friction, resulting in a burnished or polished metal surface.

The property of an abrasive to penetrate and continue to remove stock without a rapid breakdown is associated with *toughness*. This property of the abrasive mineral to penetrate the work is an initial requirement. In addition, it must also have sufficient resistance toward shearing or break-down so that the initial penetration may continue. If a mineral is hard enough to cut into the material but, due to its brittle condition, should wear away rapidly its use would not be economical.

While an abrasive must have hardness to penetrate as well as sufficient toughness to withstand the continued usage and wear on the object to be abraded, another important characteristic is the shape and type of sharp edge formed after the crude mineral is fractured or broken down through crushing to a desired grading. The cutting edges left after crushing plays an important part in the use of the abrasive; this characteristic frequently is identified as the *fracture* pattern of the abrasive.

Crushing technique is an important factor in processing coated abrasives. Each type and class of mineral has a natural formation or shape when crushed, and the manufacturer develops techniques in crushing to improve this quality. In many cases, the user of abrasives attributes efficiency of operation to the needle-like points on a fractured surface. However, this is not entirely true since such a shape may give poor abrasive results. The irregular sides or surfaces are generally dish-shaped, allowing for chip clearance. With this in mind, a classification of these five abrasive types as to relative hardness, toughness, and fracture type is given in Table I.

TABLE 1

Characteristics of Abrasive Minerals under Consideration

Mineral Type	*Hardness*	*Toughness*	*Fracture Type*
Flint	6.8 to 7.0	20%	Light wedges
Garnet	7.5 to 8.5	60%	Light wedges
Emery	8.5 to 9.0	80%	Round & blocky
Aluminum oxide	9.4	75%	Heavy wedges
Silicon carbide	9.6	55%	Sharp wedges & silvery

As is indicated in the table, the Moh's scale of hardness is used, the diamond rating a value of ten while the softest mineral, talc, has a rating of one. It will be noted that flint, emery, and garnet vary in the point of hardness, and this difference is due to the fact that, as natural abrasive, they are subject to non-uniform cooling during their formation thus lacking constancy. Artificial abrasives are constant as to their hardness value due, primarily, to the carefully controlled conditions during their manufacture. The measurement of toughness is based on percentages indicating the relative resistance toward breakdown under a given pressure.

Abrasives

FLINT OR QUARTZ:

As is indicated by its lack of hardness and toughness,

this is an abrasive that will not withstand hard production usage. As a result, this abrasive type is limited to the finishing of fine leathers and as a sandpaper in the building trades.

GARNET:

Although garnet is harder and tougher than flint, its use is generally confined to woodwording. Thus, this mineral appears to have sufficient brittleness to break or re-fracture when in use, forming new but smaller cross sections of cutting edges to permit its efficient use in the woodworking industry. Another factor is that both emery, aluminum oxide and silicon carbide are harder, with the first two mentioned minerals tougher than garnet, that economics dictate the use of these harder, longer wearing mineral types.

EMERY:

Emery is a natural mineral of sufficient hardness for use in the abrading of metal surfaces; however, the fracture exhibited by this mineral is the poorest of all the abrasives. Thus, the characteristic round and blocky fracture with poor cutting edges, along with the absence of concave sides for chip clearance, limits its use as an abrading material. However, due to the lack of a sharp fracture, it will produce a higher polish, when used in conjunction with a lubricant, than the artificial minerals, aluminum oxide and silicon carbide.

CROCUS:

With emery, crocus must be considered, for this material is generally classed with it though not in any way related. Crocus is an iron oxide which has only a mild abrasive action and, frequently, is confined to developing a polished metal surface. It is used with oil and, under high pressure, will produce a lustrous finish on a previously prepared metal surface.

ALUMINUM OXIDE:

This is the most widely used abrasive grain in the form of coated abrasive discs, cloth and paper belts, and hand sheets. It is harder than emery though not quite as tough. However, it has sufficient toughness for the abrading of metal surfaces and, when crushed, has a very favorable fracture pattern and better cutting edges as compared to emery.

Aluminum oxide, which is fourth in hardness to the diamond, is capable of penetrating practically any commercial type of metal. It is extremely tough and, therefore, resistant to wear. This artificially prepared mineral, when crushed to the desired grit size, has a blocky or regular crystal shape, usually described as a heavy wedge, that make it ideal for the cutting of harder metals. The heavy shoulder supporting the short edges gives the mineral its toughness. In a sense, the fracture of aluminum oxide can be compared to flint and garnet of lighter and sharper wedge shape, with the shape of cutting tools designed for metal lathe work as compared to the hollow ground edge developed in the tools used for chisels, plane bits, or gouges in woodworking.

Due to the greater hardness and toughness of aluminum oxide, even though it is less sharp in fracture as compared to garnet, it is capable of standing up without re-fracture or break-down under mechanical pressure of high speeds on belt, drum, disc, or other mechanical sanding device. Where a belt is driven up to twelve thousand surface feet per minute, a growing practice in the grinding of cast iron, the shock of impact when the abraisve meets the work is such that garnet, due to its relative brittleness, would shatter, lose its cutting edges and, in a very short time, lose its cutting efficiency. Aluminum oxide however, will withstand this shock and, though with a somewhat lower initial cut, will maintain its initial rate of cutting over a longer period than garnet. The same is true of resin fiber discs traveling at high speeds where the shearing stress is great. In items such as welds, where heavy stock removal is required, aluminum oxide will out-perform either garnet or silicon carbide.

SILICON CARBIDE:

Silcon carbide, which is third only to the diamond in hardness, has a fracture with the longest edges and best dished-shaped or concave sides of all the minerals. It has the most ideal fracture for coated abrasive purposes and its use is limited only by its relative brittleness. Silicon carbide is capable of penetrating any object other than diamond and boron carbide. It has sharp cutting edges, which provides rapid stock removal with a minimum of frictional heat. Its relative brittleness permits a rapid wearing action, particularly when it is used for abrading high tensile strength materials which makes it frequently too costly in applications such as this.

Silicon carbide abrasives are widely used in the sanding of lacquers, baked japans, baked enamels, phenolic laminates, glass fiber-reinforced plastics and other hard surfaces or undercoats.

In abrading metals, silicon carbide abrasives are used on the soft and ductile metals as exemplified by pure aluminum, brass, bronze, and lead castings. It is also used for the final polishing operation in wide belt polishing of sheet steel. When abrasive minerals with cutting shape or fracture having less concave sides for chip clearance, with shorter, duller edges than that of silicon carbide, are used on these and other soft "greasy" metals, the results are apt to be as follows: The duller minerals will cause the ductile surface to flow and, with increased frictional heat due to the lack of free cutting, rapid loading between the cutting crystals will take place thus minimizing the cutting action. On the other hand, since the lack of toughness of the silicon carbide abrasive is not a disadvantage in abrading these soft metals, the hard and sharp fracture of this abrasive type will cut these materials freely leaving a better finish and, in addition, will last longer.

It is frequently difficult to determine the proper metal abrasive for the job unless there is a knowledge as to the specific alloy type to be abraded as well as an experience factor as to the behavior of the abrasive mineral. Thus, that large family known as the "brasses" and the "bronzes" will vary from compositions that are relative soft to others which are very hard, resistant metals. Pure aluminum is soft and ductile; however, the commercial alloys that are en-

countered as castings, bars, and fabricated sheet products are seldom made from pure aluminum. Therefore, it is essential that the characteristics of the specific metal within a broad classification be known. Even with years of experience, it is not always possible to be right consistently in the selection of the correct abrasive. The general rule that is usually followed is the selection of aluminum oxide abrasives for the harder metals and alloys, whereas, the silicon carbide abrasives are used for the soft or "soft greasy metals."

It also should be remembered that coated abrasives actually have little in common with built-up or bonded abrasives. A coated abrasive is manufactured with but one coat of mineral, bonded accordingly to a specific job. It must be evenly graded and coated to perform properly. It must be positioned on the backing with the proper orientation and reinforced with the correct amount of glue or resin adhesive in order for the best performance to be realized. Bonded or vitrified wheels and other built-up abrasives are designed to wear away, constantly presenting new mineral cutting faces, until the product is completely used up. Accordingly, the rules in the use of bonded wheels frequently are not applicable as a guide in the selection of coated abrasives.

Types and Kinds of Backing

The backings used for coated abrasives can be classed as:—(a) paper in either "A" weight, known as finishing paper; "C" and "D" weights, known as cabinet paper; and, "E" weight, known as roll stock; (b) cloth which may be divided into light weight, flexible jeans, and, heavy weight drills; (c) fiber, which would include the "30 point" for resin fiber discs and both the "20 point" and "10 point" for drum fiber products; and, (d) combinations such as paper with light-weight cloth and cloth combined with fiber.

In many respects, the backing is as important for the job as the mineral type selected. In woodworking operations where the work is performed on a flat, even surface, paper or combination-backed paper are satisfactory and relatively lower in price. This is particularly true if there is no tendency toward strain that would rip or tear the product from its side edge. For metal sanding where sharp edges, burrs, or fins would be apt to rip or dig the backing, cloth is generally used due to its higher tensile strength. However, paper, due to its lower price, is frequently used on certain types of metal working such as light sanding, metal clean-up and the sanding or polishing of sheet metal.

In the manufacturing of paper backing, two kinds of fiber are employed. One type is the wood pulp base fiber which would include the kraft and the alpha-cellulose grades, whereas, the second type is obtained from hemp base (rope) pulp. Up to the present time, pulp can be processed into two types of paper construction, namely, fourdrinier and cylindrical paper. The fourdrinier paper is one in which all the fibers from the sheet have been laid out in a single layer, then properly dried and calendered. The cylindrical paper is one in which separate thin sheets are formed from the pulp and then combined in the wet state, then properly calendered and dried.

Kraft paper (fourdrinier) is used for flint and emery sheet only. It is a cheaper product and is not as strong as the refined grades of wood pulp paper or rope stock paper. In contrast, rope stock paper is generally a cylindrical paper containing thousands of tiny hemp fibers. It has a high lengthwise tensile strength which makes it desirable for abrasive belts and drum sander covers and, in addition, is known for its non-brittleness and high resistance to tearing. The alpha-cellulose paper, a development since 1935, has been found equal or superior in all respects to rope stock fourdrinier paper and, as such, is frequently used as a replacement as a backing for both cabinet and finishing paper.

The "A" weight finishing paper is a lightweight, flexible alpha-cellulose fourdrinier paper used for hand finishing with relatively light pressures. A lightweight paper is required so that the operator can feel the surface imperfections, whereas, the property of flexibility is desired in order tht the backing may conform to grooves, mouldings, flutes and narrow surfaces under light pressure without breaking up.

The "C" or "D" weight alpha-cellulose fourdrinier backing paper has a heavier and less flexible backing that is employed in hand working either wood or metal surfaces where greater pressures are used for stock removal. Generally, these backings are coated with coarser grits and are stronger than finishing paper. They should also possess some degree of flexibility to follow the contour of irregular surfaces.

The "E" weight or roll stock cylinder paper is noted for its higher strength to withstand both the tensile stresses developed by belt-driven sanders and the tendency toward shearing or cross-width tearing. This comparatively heavy backing has insufficient flexibility to be used on other than flat or very mildly curved surfaces. Since it is subjected to heavy pressures and stresses, an essential requirement is that the abrasive belt retain its original body throughout the life of the coated abrasive. If such were not the case, there would be insufficient support for the cutting mineral and the mineral would recede into the backing instead of standing firmly to the work.

Cloth backings, which are widely used in the form of belts, are made of jeans and drills. Jeans (J weight) are employed for belts that require a high degree of flexibility, whereas, drills (X weight) are used for the more rugged applications where heavy stock removal is required. These cloth backings are available in a number of finishes, the function of which would include:—(a) to provide a dense, non-porous surface upon which a continuous, uniform adhesive may be applied, and, (b) to saturate and hold the cloth firmly to eliminate stretch. Depending upon the degree of flexibility that is required, either glue or resins are used; the resin type finish being employed where waterproofness is required.

Vulcanized fiber is a hard, dense, horny material that is used as a backing where toughness is required for the most rugged applications. The "30 point" fiber is used in the manufacture of resin fiber discs. Both the "10 point" and the "20 point" backings are used for garnet and silicon carbide drum fiber.

In applications such as the preparation of welds, a product that is stronger than "E" weight paper backing is frequently required. This led to the development of combination backings. One combination, termed a paper combination, consists of a thin cloth, not unlike cheese cloth, laminated to "E" weight paper in which the mineral is coated on the cloth side. This backing material is specified under a general term as exemplified by garnet, silicon carbide, or aluminum oxide combinations. The fiber combination consists of a strong fiber that is laminated to a drill cloth backing onto which the mineral is coated. These discs are flexible, with sufficient body to eliminate any tendency toward wrinkling or buckling since this would cause the unsupported edges to catch and tear on the work.

Coating Types and Adhesives

There are two types of mineral coatings, namely, the closed or regular coat, and, the spaced or open coat. As its name implies, the closed coat is one where each grit particle is adjacent to the other, completely covering the backing. The open coat is one where each mineral grit particle stands by itself with a spacing or void between each grit.

The open-grain coating is non-clogging in that the material abraded will free itself quite readily from the belt. Accordingly, this coating type is preferred for the sanding of varnish, shellac and enamel surfaces, for the removal of paint, and, for the sanding of soft, gummy surfaces. Since the open-grain coat is more flexible, it is preferred for irregular contours within the work. The closed-grain coat is adapted to the sanding of hard metals, hard wood, and other non-filling materials where heavy pressures and rugged stock removal are required. Since the materials sanded have a high tensile strength and thus minimize clogging, a continuous cut at a constant rate is experienced, with a relative long life of abrasive disc or belt.

The adhesive employed to bond the abrasive to the backing would include hide glue, a combination of hide glue that is reinforced with mineral, phenolic resin, and synthetic varnish. At least two layers of adhesive are applied to the backing. The "Make Coat," the film thickness of which is depended upon the grit size of the abrasive, is initially applied to the backing as a smooth film after which the abrasive grain is deposited. It is quite important that this film wet the grain and retain it in an oriented position until the adhesive is dry. The "Size Coat" is required to give the necessary reinforcement to the grain and complete the rigidity of bonding to the backing.

Hide glue will realize a high strength film; however, it will quickly soften in water and the surface may become "sticky" under conditions of high humidity. It has characteristic properties of toughness, resistance to impact, flexibility, and remarkably high adhesiveness for paper and cloth backings as well as standard abrasive grains. A development is the use of hide glue reinforced with minerals; the mineral particles, which are held to a standard range of particle size, reduce the sensitivity of the glue to moisture. They distribute the physical stresses within the glue film and provide a cushion against shock when the coated abrasive is used in machine applications.

Phenolic resins are used where very rugged operations are to be encountered; the film being hard, shock resistant, and of high strength. Due to the nature of this adhesive, the film must first be dried and then cured at about 300°F. to complete the chemical reaction. In the event that this adhesive type is too brittle, a resin coat over a more ductile hide glue base may be used. The waterproof products involve drills in which both the make-up and size coats are of a phenolic resin, resulting in a product that is high resistant to water, solvents, and oils, as well as to extreme physical abuse.

Synthetic varnishes are used exclusively in the manufacture of wet paper products. The varnishes used are flexible, tough, and have excellent adhesiveness for both the grain and the backing. In spite of their flexibility, they are capable of rigidly holding the abrasive grains on the waterproof backings.

A recent development of the coated abrasive industry is the introduction of non-loading products. A film of zinc stearate is applied on finishing or cabinet paper, the function of which is to prevent paint particles or other soft materials from accumulating within the voids of an open coating. An efficient method of application of the zinc stearate is its suspension in an adhesive bond as a continuous, lacquer-like coating. As a result, these papers permit the grains to cut until the product has reached the end of its useful life.

Storage of Coated Abrasives

The conditions under which abrasive paper is stored may affect the subsequent performance of this material. The product consists of a backing material, an adhesive and an abrasive: the first two components are sensitive to climatic conditions and will gain or lose moisture in accordance with the relative humidity. As an example, paper and cloth may contain from 6.0 to 10.0 per cent moisture when in equilibrium with average atmospheric conditions. Under these same conditions, hide glue may contain from 10.5 to 15.0 per cent moisture. As the humidity conditions of the atmosphere rise or fall from the average value, the moisture content in both the backing and adhesive bonding material will vary accordingly. A continual cycling of the moisture content that may result from changes in humidity will set up strains between the abrasive and adhesive components, resulting in a weakening of the bond and subsequent impairment of the performance quality of the paper.

In addition, paper that is exposed to high humidity conditions prior to actual usage will tend to fill and clog in service. The high moisture content will cause it to soften under the frictional heat that is generated during use. This softening of the bond may permit the cutting edges of the abrasive granules to bend away from the direction of sanding.

To prevent deterioration in storage and to insure the proper service in use, paper should be stored in a room held at reasonably constant temperature and relatively humidity. The temperature should be between 60 and 80°F. while the relative humidity should be preferably around 50 per cent.

The ideal storage room would be one where the walls were inside partitions with neither steam heated

radiators nor hot air inlets in the storage room. For most regions of the country, it may not be necessary to consider dehumidification of the air. Summertime conditions, on occasion, may result in relative humidity well over 50 per cent but, in general, the condition would not persist long enough to unduly harm the paper. However, wintertime may require humidification of the storage room. This will prevent the paper from becoming too dry and inflexible, which may cause difficulty in handling without cracking of the material.

It is preferable to store abrasive paper in the container in which it is received. It should be stacked on open shelves which will permit a reasonable circulation of air. If there is any danger of damp walls or floors, the paper should be stored a sufficient distance away from these damp surfaces to permit adequate circulation of air. Glue, since it is a protein-base material, is subjected to attack by mold and mildew, and any localized dampness may cause damage even though the conditions in most of the room is satisfactory. Paper, that is stored under the recommended conditions, will retain its efficiency and usefulness over a long period.

Operating Variables

There are a number of variables that will have an effect on a grinding or finishing operation which should be recognized and considered. Although there may be exceptions to the general observations that will be given, it is believed that a knowledge of these variables and their effects will help those who are considering the application of abrasive belts.

In regard to minerals, the finer the grit, the finer will be the finish. In choosing an adhesive bond, the harder the bond, the coarser will be the finish. Resin-bond products will produce coarser finishes than the glue-bond products. The heavier the pressure, the coarser will be the cut.

BELT SPEED:

This is normally expressed as the number of feet a given point on a belt will travel in a minute. With all other factors being equal, a higher belt speed will generally:—(a) improve the finish, due to less penetration and "cleaner" chip break-away; (b) reduce glazing, since the greater shock to the grain tips will encourage sharpening and fracturing; (c) reduce loading, due to the higher centrifugal force when the belt reverses itself at the idler; and, (d) increase rate of stock removal, due to the greater number of cutting tips that will contact the work per minute. Table 2 is offered as a guide to proper belt speeds; however, experimental work may be required in considering the variables under discussion.

CONTACT WHEEL:

Contact wheels, which back up the belt, are selected according to the material and hardness best suited for the job. Normally, the harder the contact wheel, the coarser will be the finish. Rubber-covered wheels usually produce better belt efficiencies than other wheel types. The softer wheels (Durometer 10-30) are used for fine polishing and contour grinding; the medium-hard wheels (Durometer 30 to 60) are for normal polishing operations to obtain a reasonable finish; and, the hard wheels (Durometer 60-90) are used where an increased cutting action is required. Serrated rubber wheels, as compared to the solid type previously discussed, usually produce the fastest cut and permits a longer belt life. Normally, the greater the separation between the lands on a serrated contact wheel, the more aggressive will be the cut and, consequently, the coarser will be the finish. Cloth contact wheels, as exemplified by compressed canvas and full-disc wheels, are also used; the advantage of the former type being factory-formed wheels to a customer's template or work-piece. As to contact wheel diameter, the larger diameter will realize the finer finish.

TABLE 2

Recommended Speeds

Material	*Speeds, sfm.*	*General Remarks*
Mild steel	5500-7500	Heavy grinding applications
	7500-10,000	Polishing applications
Aluminum, zinc, copper and some copper base alloys, die castings	9000-12,000	Generally used in conjunction with a grease-stick or other suitable lubricant
Grey cast iron	12,000	
Thermoplastics	850	Plastics that soften with heat will "flow" at higher speed, reducing stock removal, loading the belt, and ruining the finish
High tensile steel alloys		Determined experimentally. Require much lower speeds and are very sensitive to speed changes. Slight changes in composition, or, changes of 500 sfm on either side of the optimum speed for a specific alloy may result in as little as 50% belt efficiency.

LUBRICANTS:

Lubricants will generally produce a finer and more uniform finish, reduce heat generation at the contact point, and prevent loading and subsequent glazing of work. The effectiveness of a lubricant is determined by the viscosity at the contact point; the heavier viscosity giving the better finish. Compounded oils are being used increasingly, particularly as a fine spray or mist on automatic and semi-automatic equipment. Oil lubricants are particularly effective in the polishing of non-ferrous metals where glue-bonded cloth belts are employed. The resin-bonded wheels do not respond nearly as well since they are not as porous as the glue-bonded belts.

With all other variables being equal, the finish on materials is difficult to assess. However, for efficient production, it may be necessary to change some of the variables to suit the material. If one were to use the axiom that, as the rate of cut decreases finish improves, the harder materials would seemingly receive the finer finish. On some soft materials, however, finish may not be entirely a matter of scratch pattern, as the temperature at the point of contact

may be such that the material will plasticize and actually achieve a finer finish than that produced by the normal scratch pattern.

FEED DIRECTION:

The direction of feed will influence the type of cut. A feed against the belt rotation will produce a coarser cut than when the material is fed in the direction of belt rotation. Belt wear tends to decrease the size and sharpness of the abrasive grains and, as a result, will decrease the depth of penetration. Consequently it will produce a finer finish as the belt wears.

FLEXING:

Although flexing is a very important step in the manufacturing process, the user frequently does not have a complete understanding of this vital operation. Flexing may be defined as a controlled and uniform cracking of the glue and resin adhesive bond to facilitate ease of handling. The degree of flexing is a function of the end use of the material.

Coated abrasives, as they come from the drying ovens, are stiff and brittle, particularly in the coarser grits. All coated abrasives have two adhesive coatings, the first a "maker" coat in which the grain is embedded and the second a thin "sizing" coat which surrounds each grain and anchors it to the marker coat. When these adhesive coats dry, or are "cured," they form a hard, rigid layer tightly gripping both backing and abrasive grain. The flexing process, which is performed on specialty equipment, minutely and uniformly cracks this adhesive layer in such a way that the continuity of the coating is broken so that the finished product will bend or roll easily.

While there are four basic standard flexes, some items require none, a typical example of which would be garnet, and silicon carbide coated finishing paper. Other things being equal, it is generally true that the material having the least flexibility necessary to do the job will cut fastest and last longest. Single-flexing is a mild flexing across the web at an angle of 90 degrees. The majority of cloth and paper products are single flexed, particularly the coarser grits.

Double-flexing is achieved by pulling the material under tension over steel flexing bars set at an angle of 45 degrees in opposite directions. Paper products are never double-flexed, and a comparatively few cloth products are treated in this manner. However, resin-bond aluminum oxide cloth products from grit 320 to 80 are double-flexed. Triple-flexing consists simply of a combination of single and double flexing, i.e., a 90 degree flex plus two 45 degree flexes. The extreme triple-flexing is obtained for special uses by giving a triple-flexed material an additional 90 degree flex using a combination of heavier tension, a more severe angle of pull, and a special shaped flexing bar.

ANODES

(*Continued from page* 51)

Many of the troublesome features of anode bags can be eliminated by using some sort of diaphragm — in effect a glorified single anode bag. Developed particularly in connection with P. R. plating, these have much to commend them and deserve wider application; certainly they eliminate the poor anode corrosion experienced when the anodes in cyanide solutions are bagged.

The principle is to separate the tank into two compartments with a fabric membrane, and to use the pump to transfer enriched solution from the anode compartment, via a filter to the cathode section. Properly maintained, there is virtually no possibility of anode slimes finding their way into the catholyte.[12]

The most satisfactory system is to design the tank to incorporate a diaphragm.[13] Such a tank can normally accommodate only one cathode bar, and needs to be somewhat larger than usual to lessen the risk of work brushing against and ripping the diaphragm. This increased anode-cathode spacing does improve throwing power and metal distribution, though. A rigid metal frame, usually of rubber-covered steel, is built up within the tank, positioned far enough from the tank walls to allow for the convenient handling of the anodes. This can take the form of a removable tubular structure over which a complete diaphragm is stretched, or a fixture into which a number of insulated expanded metal frames fit tightly; the latter allows for more convenient maintenance. The diaphragm is least expensively made of heavy canvas duck, e.g. a double layer of 11 oz. material. This has been found to have a life of 6 or 9 months, but the more expensive synthetic fabrics may be preferred for longer life; alternatively, the canvas can be resin coated at solution level where deterioration is most rapid, while several thicknesses of material may sometimes be considered justified.

The weave must be sufficiently fine to prevent the electrophoretic migration of anode particles but, by arranging an adequate pumping pressure, a slight hydrostatic head of solution can be achieved in the cathode compartments. This will restrain the passage of particles without the necessity for unduly fine weaves and large voltage drops. Also useful in keeping the surface of the catholyte free from floating particles, is to fix the diaphragm's height so that there is a slight flow of solution over it into the anolyte. Separate filtration of the catholyte may prove desirable and can be achieved by having suction pipes, controlled by valves, in each compartment.

Another diaphragm system consists of large, insulated, expanded metal baskets, covered with a suitable fabric, in each of which are hung several anodes. Each basket is provided with a suction intake to the filter-pump and compressed air agitation to prevent anode polarization.

The use of a porous ceramic diaphragm has been proposed but, while superficially attractive, its high cost and inherent fragility would militate against any widespread acceptance.

(*To be continued*)

Evaluation of Paint Spray Booths

By J. Arthur Weed, *Consultant, Kirklyn, Pa.*

Exhaust Systems for Spray Booths

IN many plants paint spray booths have been installed with little thought given to matters other than meeting the minimum requirements of the local and/or state laws. Certainly these laws must be complied with; but the planning of a spray booth installation should go much further.

In many manufacturing plants paint rejects are, to a large extent, caused by inadequate exhaust systems. In one particular company making parts for the automotive industry, rejects in the painting department were running as high as 28 per cent. The cost of stripping and refinishing these rejected parts was prohibitive and a cure has to be found.

A survey of the painting area, showed that the company had a total of seven spray booths, both dry type and water wash, exhausting an average of 3,500 cfm./per unit. When one tried to enter this area it was almost impossible to open the doors leading to same. There had been no provision made for make-up air. Dust and dirt from the plant area were being drawn under doors and in cracks or crevices that existed.

After this condition was brought to the attention of management, a fresh air supply system was installed. A slightly greater amount of clean, fresh, filtered and heated air was introduced to the painting area than was being exhausted. The number of rejects after this change was less than 1 per cent, and these were largely due to handling.

This condition prevails in many plants today. Replacement for exhaust air in paint spray booths must come from somewhere. Only by the use of a properly designed air supply system can one avoid contamination of his painted products by dirt from the shop area.

Dry type paint spray booths are used quite extensively, especially where the paint work load is not extremely heavy. When a plant is located in a heavily populated area, the exhausted material usually presents a problem. With air pollution laws becoming more stringent, it is often essential that the plant owner take steps to correct this condition.

Not only is the dumping of paint laden air to the outside of the building a nuisance, but the accumulation of paint in the ducts, fans, and associated equipment, present a very serious fire hazard. If a dry-type paint spray booth is currently in use and it appears not to be economical to replace it with one of the water wash type, investigate the use of paint arrestors or dry-type filters. These may be installed in an existing booth. They do an excellent job of preventing paint from getting into the exhaust area. They are usually installed in the eliminator section of the booth and in double banks. When the front set is contaminated, they are removed, discarded, and the rear set moved forward. New units are then installed at the rear. Filters of this type will considerably reduce maintenance costs, since less cleaning of the fans, ducts, etc., are necessary.

In many states, the minimum requirement for exhaust velocity of a paint spray booth, is 125 fpm across the booth opening. Sometimes it is necessary to have a greater velocity than this, due to the nature of the work, the paint loading or other conditions that may prevail. Conveyor openings in the booth, have to be considered when calculating the size fan necessary. If one is currently using electrostatic painting equipment, he will find that manufacturers of this type equipment prefer lower velocities than mentioned here. This is because high velocity exhaust has a tendency to pull the paint from the work surface while it is in flight. Pressures used in this type of operation are frequently of necessity lower.

Advantage of Water Wash Spray Booths

Water wash paint spray booths have been in use for many years and there is much to be said in their favor. Whether one uses small or large quantities of paint, the use of this type of booth will improve working conditions, reduce maintenance costs, fire hazards and, in general, make the plant, a safer, cleaner place to work. The purchase of a water wash type of booth, is something that should be investigated thoroughly, before ordering. There are many suppliers of this type of equipment and, of course, each of them feels that his type of booth is best.

A water wash booth should be constructed of heavy gauge metal. The collecting tank should be made of $\frac{3}{16}$" steel, double welded for long life. The washer or eliminator section of at least 12-14 gauge steel. The plenum section could be of 16-18 gauge and the booth section of 18 gauge, properly reinforced. Booths constructed of the above materials will give long service and with minimum maintenance costs. The collecting or water tank should have a capacity of at least three times the pump hourly capacity. This is very important, since the larger the tank, the less possibility there is that paint, which is

(*Continued on page 60*)

Sulfate Determination in Chromium Plating Solutions

Volumetric Method Using E. D. T. A.

By Saburo Konishi, *Fuse Directing Bureau of Industry, Osaka, Japan*

IN the quantitative determination of sulfuric acid content of chromium plating solutions, the gravimetric method described by Hall,[1] in which barium sulfate is precipitated from the reduced solution, filtered, ignited and weighed, has been widely employed heretofore. This is a time-consuming method, which does not lend itself to shop control, so that a search for a more rapid procedure was instituted. The known solubility of barium sulfate in alkaline solutions of ethylenediaminetetraacetate (E.D.T.A.) led to investigation of methods employing this reaction and a successful procedure was developed, which is reported in this paper. In outline, the method involves dissolving the precipitated barium sulfate in a measured excess of E.D.T.A. standard solution, in the presence of ammonia, followed by back-titration of the excess E.D.T.A. with standard zinc chloride solution, using Erio Chrome Black T indicator.

Experimental

REAGENTS:

1. Ethylenediaminetetraacetic acid-disodium salt. Approx. 0.05 M. Dissolve 19 g. of the dihydrate salt and dilute to exactly 1 liter with distilled water. This is standardized against the standard zinc chloride solution.
2. Zinc chloride. 0.05 M. Dissolve 3.23 grams pure zinc in hydrochloric acid and dilute to exactly 1 liter with distilled water.
3. Erio Chrome Black Indicator. Dry mixture of 0.1 g. indicator and 10 g. sodium chloride.
4. Ammonium hydroxide. Concentrated.
5. Hydrochloric acid. Concentrated.
6. Acetic acid. Glacial.
7. Ethyl alcohol. Denatured.
8. Barium chloride. 10% solution.

PRELIMINARY:

A 0.05 M solution of barium chloride was prepared and analyzed by precipitation as barium sulfate. The analysis was determined to be 7.9559 g./l. Ba^{++}. To measured amounts of this solution were added 150 ml. distilled water in a beaker and 25 ml. standard E.D.T.A. solution. Ammonia was then added to obtain pH values of both 10.5 and 11.3, after which the solutions were titrated with the standard zinc chloride solution, using sufficient dry Erio Chrome Black indicator to produce a deep blue color. At the end point there is a sharp color change from blue to red. The results are shown in Table I.

TABLE I

0.05 M $BaCl_2$ (Ba^{++} = 7.9559 g./l.)	*pH*	*0.05 M $ZnCl_2$*	*Ba^{++} Found*
0.00 ml.	10.5	18.90 ml.	.....
2.00 ml.	10.5	16.85 ml.	7.9006 g./l.
5.00 ml.	10.5	Unclear Endpoint	.....
10.00 ml.	10.5	Unclear Endpoint	.....
0.00 ml.	11.3	18.90 ml.	.....
2.00 ml.	11.3	16.85 ml.	7.9006 g./l.
5.00 ml.	11.3	13.70 ml.	8.0409 g./l.
10.00 ml.	11.3	8.47 ml.	8.0722 g./l.

BARIUM SULFATE ANALYSIS:

To measured amounts of 0.05 M barium chloride solution in beakers were added water and equivalent amounts of standard sulfuric acid to precipitate barium sulfate. This was followed by 25.00 ml. of E.D.T.A. solution and 10 ml. ammonia. The mixture was heated on a water bath until the precipitate dissolved completely, which required from 5 to 10 minutes, and then allowed to cool to room temperature. The solution was then titrated with zinc chloride, after making an addition of 5 ml. ammonia, using dry indicator as above. The results are shown in Table II.

TABLE II

0.05 M $BaCl_2$ (Ba^{++} = 7.9559 g./l.)	*0.05 M H_2SO_4*	*pH*	*0.05 M $ZnCl_2$*	*Ba^{++} Found*
0.00 ml.	0.00 ml.	11.3	18.91 ml.	.....
5.00 ml.	5.00 ml.	11.3	13.70 ml.	8.0409 g./l.
10.00 ml.	10.00 ml.	11.3	8.46 ml.	8.0799 g./l.

Application to Chromium Solutions

Two chromium plating solutions were prepared, a 22° Bé and a 24° Bé bath, and sulfate contents were determined gravimetrically by Hall's procedure,[1] and by the E.D.T.A. method, as given below, with the results shown in Table III.

PROCEDURE:

1. Pipette a 10 ml. sample of chromium plating

solution into a 400 ml. beaker. Add 10 ml. distilled water, 10 ml. hydrochloric acid, 15 ml. acetic acid and 20 ml. alcohol. Boil 30 minutes to reduce the hexavalent chromium to trivalent.

2. Add, while stirring, 15 ml. of 10% barium chloride solution, boil for 1 minute, and allow to settle for 1 hour.

3. Filter, using a quantitative filter paper, and wash (Steps 1-3 are the same as for the gravimetric method).

4. Transfer the precipitate and paper to the beaker and add 150 ml. distilled water.

5. Add 10 ml. ammonia and 25.00 ml. E.D.T.A. solution, then warm to 60-70°C. and stir until the precipitate dissolves.

6. Cool and add additional ammonia (5-10 ml.).

7. Titrate with standard 0.05 M zinc chloride solution, using Erio Chrome Black T indicator, to a red color.

Calculation: H_2SO_4 (g./l.) $= 0.490 \times (500 \times M$ E.D.T.A. $-$ ml $ZnCl_2)$

TABLE III

	22° Bath	*24° Bath*
Barium sulfate (gravimetric)	0.0412 g.	0.0687 g.
Sulfuric acid (gravimetric)	1.73 g./l.	2.89 g./l.
Sulfuric acid (E.D.T.A.)	1.71 g./l.	2.84 g./l.

FLUOSILICATE BATHS:

In Japan, sodium fluosilicate has been finding favor as an addition to sulfate chromium baths. Therefore, determinations were also made on a commercial solution of the following analysis:

Chromic acid, CrO_3	265.5 g./l.
Cr^{+++}	0.89 "
Fe^{+++}	Trace
Na_2SiF_6	11.0 g./l.

The sulfate content of this bath, as determined gravimetrically, was found to be 1.70 g./l. Using the E.D.T.A. method, the analysis was determined to be 1.67 g./l., indicating close agreement and no interference. The results reported in these experiments are the mean value of three titrations.

Conclusion

As shown by the above tests, satisfactory results can be obtained for the sulfate content of chromium plating solutions, by titration with E.D.T.A. solution. Compared with the gravimetric method, the new procedure is simpler and quite accurate. Standard zinc chloride solutions are obtainable from laboratory supply firms, against which the E.D.T.A. solution can be standardized, so that the need for an analytical balance is avoided completely. An inexpensive chemical scale is suitable for weighing out the required materials. The barium sulfate can be redissolved in the same beaker in which it was precipitated. It is only necessary to wash out the trivalent chromium and excess barium and, if the highest degree of precision is not required, this can be done by decantation.

Reference

1. Hall, Nathaniel. Metal Fin. Guidebook-Directory, p. 581 (1958).

EVALUATION OF SPRAY BOOTH

(*Continued from page* 58)

being recirculated in a wet state, will foul the pump, baffles, and associated equipment.

Early type water wash spray booths attempted to wash the paint from the air stream by means of a series of nozzles. Unfortunately, these nozzles became fouled with the wet paint and, in a very short time, the booth was not doing its job. To remove any paint that got by the washer section, a series of zig-zag eliminator plates were used. These also became fouled with paint and had to be cleaned frequently and this procedure was very costly. Most manufacturers of this type spray booth currently use a different system of washing the paint laden air.

The use of axial flow fans in this type of booth, when the resistance is up to 3" S.P., is becoming more prevalent. When the resistance is higher, as it is with some types of booths, the makers then use a centrifugal fan. Either will do an excellent job if the washer section is properly designed. Staggered baffle plates remove entrained moisture from the air stream yet do not present the same maintenance problems which zig-zag sections cause. Most of the larger users of this type of equipment, who have experienced the problems associated with the early types of booths, insist on quality construction and good engineering design in the equipment they now purchase.

It is also wise to prepare a comparison sheet when considering the procurement of any size of booth. In this manner, you will be able to evaluate all of the features that the various companies, who are bidding, have to offer.

The painting of large objects often present problems when conventional side draft spray booths are used. Booths of the down-draft type are available which will do a better job on this type of product. Use of a down-draft booth will permit overspray to be drawn down through a grating and thereby carried away from the breathing zone of the operator.

There is also a portable water wash booth on the market, that does an excellent job of handling paint laden air. This booth is also ideal for the painting of large, bulky objects, such as railroad cars, locomotives, buses, trolleys, and many other products too numerous to mention.

This booth straddles the work being painted and is propelled in either direction by a mechanical drive. Water wash sections are used on both sides and permit two or more operators to work at the same time. Automatic scaffolding is usually used so that the operators may work at any level required. As these units are, in most cases, completely portable, they have their own air supply, paint circulating systems, and fire protection, integral parts of the unit.

The exhaust system is quite ingenious and the installations appear to be doing a very good job.

There are many quality manufacturers of the equipment that has been outlined here and, if in doubt as to what the needs may be, they should be called upon for advice.

Plating Waste Disposal

Integrated System at Ronson Corporation

By Walter Mikos, *Plant Superintendent and*

Alfons Szkudlapski, *Chief Chemist, Ronson Corporation of Pennsylvania, Delaware Water Gap, Pa.*

Walter Mikos attended LaSalle Extension University in Chicago. He spent twenty-three years in the appliance industry with Norge and Bendix holding positions in experimental development and as plant manager. He came to Ronson in 1954 and in 1956 he became plant superintendent for the manufacture of all lighter and accessory production.

Alfons Szkudlapski is a graduate of the University of London, England where he obtained a B.Sc. degree in chemistry in 1952. The following three years he worked as an electroplating chemist in England. He has been with Ronson Corporation since 1956 as chemist and plating supervisor. He is a member of ACS, AES, Electrochemical Society and Institute of Metal Finishing.

RONSON CORP., the world's largest manufacturer of cigarette lighters, produces thousands of chromium plated parts every day. A waste disposal problem was created in 1954 when all the company's manufacturing facilities were transferred from Newark, N. J. to East Stroudsburg, Pa. There was no waste problem as such in the big metropolitan area, the wastes being rendered harmless by dilution in the municipal waste disposal system, but quite a different solution had to be found in the heart of the beautiful Pocono Mountains.

In designing the new plating room and waste disposal facilities at East Stroudsburg, the integrated type of treatment system, designed by *Dr. L. E. Lancy*, was chosen since it has been approved by the Pennsylvania State Department of Health. This system is based on chemical treatment of the toxic compounds (cyanide, chromic acid, etc.) and their removal from the work and racks *before rinsing*. The treatment tank is an integral part of the finishing line and is constantly recirculated to a larger treatment solution reservoir. The chemicals consumed are replenished by additions at the reservoir tank and the precipitated salts removed by settling. A considerable excess of chemicals in the solution avoids the need for close control and maintains the concentration regardless of drag-in fluctuations. Since the treatment solution is not discarded (except at intervals as described below), the higher concentration does not result in wasteful consumption of chemicals. The waste disposal system has now operated satisfactorily for two years at the East Stroudsburg, Pa. plant.

In 1957 a modern 110,000 square foot plant was built in Delaware Water Gap, Pa., a few miles outside East Stroudsburg and all manufacturing departments were transferred to the new location. The new plating department (Figure 1) and waste treatment facilities were incorporated in the original plan of the factory. All the equipment used at the old factory such as automatic plating machines, pumps, heat exchangers, and waste treatment tanks, plus several thousand gallons of plating solution, were transferred to the new location. Some new equipment was added. Basically, the same waste treatment system was installed as operated at the old plant. Some changes were made to take care of additional production, e.g., neutralizing of acidic rinse waters resulting from the operation of a new bright dipping line.

Cyanide System

The integrated cyanide waste treatment system is shown schematically in Figure 2. The cyanide treatment solution washes the drag-out from the work and the plating racks in the treatment tank and is continuously recirculated to the reservoir. Toxic waste is oxidized by alkaline chlorination in the 200 gallon treatment tank as a regular step in the production line of the copper-nickel automatic plating machine. This treatment tank is connected to a 1500 gallon reservoir

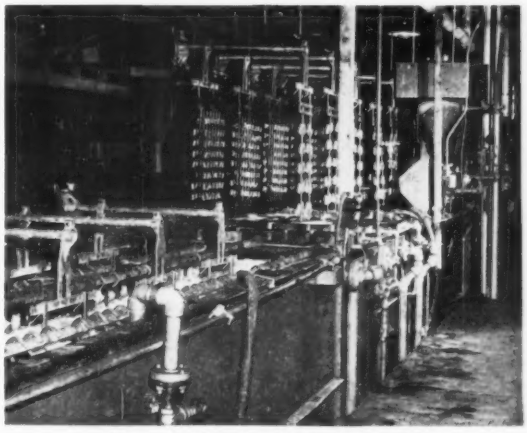

Fig. 1. A View of the Plating Department.

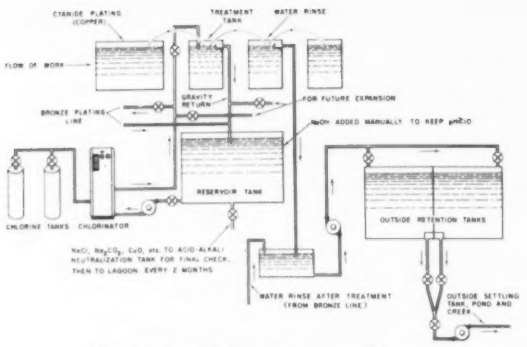
CYANIDE PLATING (COPPER)
TREATMENT TANK
WATER RINSE
FLOW OF WORK
GRAVITY RETURN
FOR FUTURE EXPANSION
BRONZE PLATING LINE
NaOH ADDED MANUALLY TO KEEP pH10
RESERVOIR TANK
CHLORINE TANKS
CHLORINATOR
OUTSIDE RETENTION TANKS
NaCl, Na2CO3, CuO, etc. TO ACID-ALKALI NEUTRALIZATION TANK FOR FINAL CHECK, THEN TO LAGOON EVERY 2 MONTHS
WATER RINSE AFTER TREATMENT (FROM BRONZE LINE)
OUTSIDE SETTLING TANK, POND AND CREEK

Fig. 2. Cyanide Waste Treatment System.

tank, Figure 3, located in the pit of the waste treatment area to form a continuous recirculation system. The treatment solution in the plating line returns by gravity to the reservoir tank located in the pit. The reservoir tank feed line branches off to serve another treatment tank in the bronze plating line, the pump having sufficient capacity to serve both lines. A third branch, presently unused, has been provided for future expansion.

The pH of the treatment solution in the recirculation system is maintained at 10 or above by adding 50% sodium hydroxide solution manually to the reservoir tank. On the average this needs to be done only once daily. pH is checked every few hours using test paper.

The solution from the reservoir tank passes through a continuous, solution feed, gas chlorinator, where chlorine is added at a rate sufficient to maintain a chlorine residual of about 200 ppm. Free chlorine is checked before plating operations start in the morning and every two to three hours thereafter by the plater. Test paper suffices for these checks, but periodically the laboratory confirms them with a colorimeter.

Chlorine dosage averages 25 pounds per day, so that total daily consumption is about eight pounds per eight hour shift. The rate of chlorine feed depends on the amount of work being plated (there are two parallel plating lines in the copper-nickel machine) and the shape and size of the articles plated, resulting in different drag-out rates of the cyanide plating solutions.

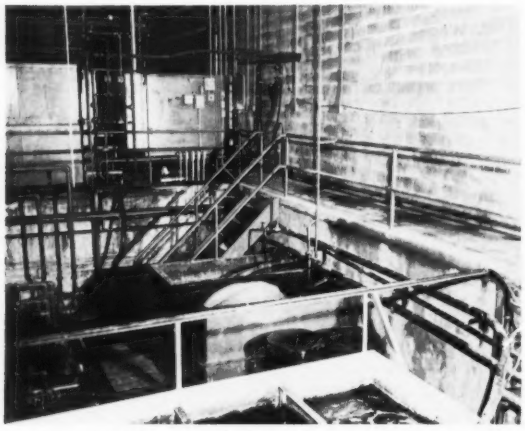

Fig. 3. Cyanide System Reservoir Tank.

The chlorinator is a vacuum-type, solution-feed unit. It is very convenient to use since the rate of flow is easily adjusted manually at the chlorinator (Figure 4) and there has been no problem with the escape of chlorine gas or corrosion.

The rinse water from the tank after the treatment wash station is continuously pumped to one of two 8000 gallon retention tanks, located outside (Figure 5). At the end of each shift a sample of the rinse water from the outside retention tank is analyzed. This is also done before the tank contents are pumped out into the final settling tank. It takes about two days to fill one retention tank. While the contents of the full tanks are being analyzed, another tank is being filled.

The treatment solution gradually builds up a concentration of nontoxic salts, such as NaCl and Na_2CO_3, plus precipitated insoluble salts such as CuO and $Cu(OH)_2$. It is discarded about once every two months.

First the treatment solution is pumped into an acid-alkali neutralization tank and held there for at least two or three days. A test for free chlorine is then made. If

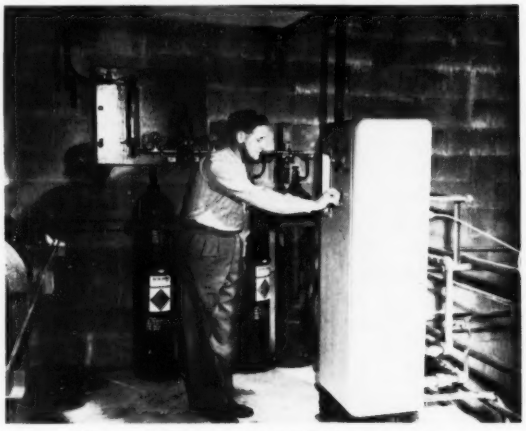

Fig. 4. Operator Adjusting Chlorine Flow Rate.

the test is negative, sodium hypochlorite or calcium hypochlorite is added until the test is positive. The solution is held for another two or three days and the test repeated. After a positive chlorine test at this time, the solution is analyzed for the exact content of free chlorine. Free chlorine is next reduced with sodium bisulfite, the pH is adjusted to 6-7, and the entire contents of the tank are pumped out to one of the sludge beds (Figure 6). One of the two sludge beds is thus being filled slowly with a nontoxic, highly concentrated sludge of NaCl, Na_2CO_3 and metal salts. The second sludge bed will be used when it becomes necessary to re-excavate the first bed.

Chromium System

The integrated system for treating toxic chrome waste is shown schematically in Figure 7. The hexavalent chromium in the chromic acid solution is reduced to trivalent chromium (as chromium sulfate) in the first treatment tank, and the trivalent chromium drag-out is precipitated in the second treatment tank.

The reducing agent in the first treatment tank is gas-

eous sulfur dioxide which is added continuously to the reservoir tank at a controlled rate. The gas is added through a pipe diffuser after passing a pressure regulating valve, flowmeter, and vacuum breaker. The use of gaseous sulfur dioxide provides the following advantages:

1. Ease of handling and control of flow rate.
2. The sulfurous acid formed in the solution regulates the pH, eliminating the need for acid additions.
3. The basic chromic sulfate formed will require less alkali for precipitation.

The pH of the reducing solution is maintained at about three. The flow rate of the sulfur dioxide is adjusted manually to control the sulfur dioxide concentration as indicated by the pH of the solution and analysis for SO_2 reducing power. The solution is analyzed twice daily for excess SO_2 and once daily for pH with test paper.

A wetting agent is maintained in this solution. The capacity of the first treatment tank is 200 gallons and

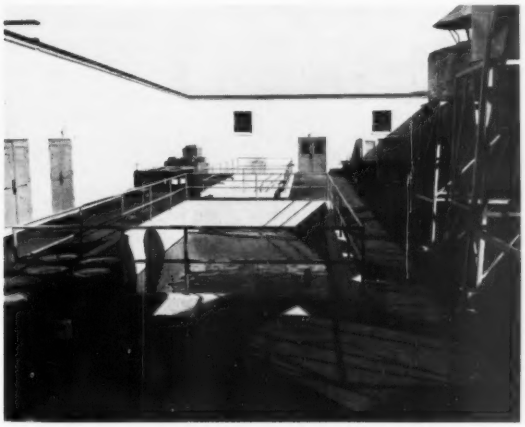

Fig. 5. Two Eight Thousand Gallon Retention Tanks.

it is constantly recirculated through a pump to a 600 gallon treatment solution reservoir.

The soluble trivalent chromium drag-out on the work and plating racks is precipitated in the second treatment tank as insoluble chromic hydroxide by a solution of sodium carbonate, caustic soda and a small amount of lime. This solution is maintained at a pH of 8 to 10. An active reducing agent (about 2 oz./100 gal. sodium hydrosulfite) and a wetting agent are also kept in this solution.

The second wash tank is connected to another 600 gallon reservoir tank in a continuous recirculation system. This recirculation system is such that some treatment solution is sprayed over the top of the carrier arms, plating racks, hooks, etc. to wash off any chromic acid residue picked up during plating. This treatment is followed by a spray rinse to remove all the alkaline solution residue.

Chemical consumption in the second solution is small as only the chromic salts dragged in from the first step are precipitated. Replenishment twice daily is sufficient. The solution is checked twice daily for excess $Na_2S_2O_4$ with test paper and for pH once daily

Fig. 6. Sludge Beds.

with test paper. The first treatment solution is discarded monthly. It is pumped to a neutralization tank, where dry lime is added. The neutralized slurry is then pumped to the sludge bed. The alkali treatment solution is discarded about once every three months. It is also pumped to the sludge bed.

As described before, the rinse waters after the second chromium treatment tank and the rinse water after the cyanide treatment steps (collected first in the retention tank) flow to the final settling tank. Also flowing to this tank are all the rinse waters originating from the alkaline cleaners and acid dips and the effluent from the bright dip neutralization tank. The water from this 25,000 gallon settling tank overflows into a small creek which is dammed to form a pond (Figure 8). Continuous check of the contents of the overflowing final settling tank fails to reveal any trace of toxic waste. This is confirmed by a flourishing fish colony in the pond.

Additional Facilities

Separate tanks are provided in the waste area for batch treatment of any discarded cyanide or chrome solutions. Floor drains throughout the plating room collect spillage resulting from overflowing tanks, leaks, careless handling of chemicals, etc. These drain lines are connected to a dry spill sump. The contents of the sump are analyzed regularly and treated when neces-

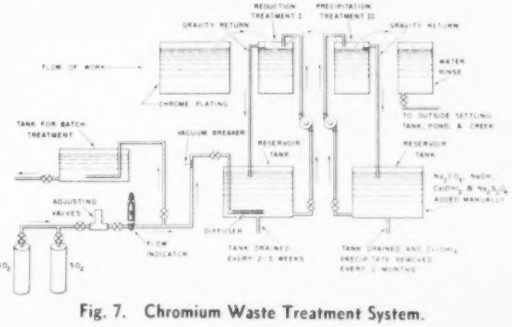

Fig. 7. Chromium Waste Treatment System.

Fig. 8. Pond and Creek Where Treated Waste Is Discharged.

sary. Afterwards the contents of the sump are lifted with a portable pump into the acid-alkali neutralization tank for final neutralization and settling.

Special sumps are located below the copper cyanide and chromium plating solutions on the automatic machines. The tanks holding the plating solutions are supported over sumps. In each case any tank leakage or overflow collects in the sump where a special pump working on a probe system automatically begins pumping the sump contents into the treatment tanks. The probe also actuates an alarm.

Overhead plastic pipelines connect the plating department with the bright dip area in the soldering department. There are many special connection points along these collecting lines where finishing waste (spent acids, cleaners, strip solutions etc.) can be pumped. These lines slope slowly down from the farthest points and reach a low point over the big acid-alkali neutralization tank, permitting a complete drainage of the lines at all times.

A continuous alarm system is connected to all condensate return steam lines in the plating department. The lines are monitored by conductivity bridges to indicate and sound an immediate alarm when even the minutest leak occurs in the heating coils or heat exchangers. In this case, the steam condensate by-passes the condensate return pumps and is wasted to the spill sump.

Since its installation, the integrated waste treatment system has operated to the company's complete satisfaction. Since the toxic compounds are removed from the work before rinsing, a better rinse is achieved with less water consumption. This, in turn, results in better and easier plating, considering the intricate shapes involved and the high quality finish desired.

Electroless Nickel Plating of Carbon

By Harry J. West, Ch.E., *Bloomington, Ind.*

PREVIOUS disclosures on electroless nickel plating have dealt with the coating of ferrous and nonferrous metals and of plastics, and it has been found that most materials, if properly prepared, can be plated successfully with electroless nickel. Certain components of missiles and space craft are fabricated from carbon and, in some applications, it was found necessary to produce a good adherent metal coating on this material, for example, prior to flame plating with tungsten. After considerable experimentation with different finishes to withstand high temperatures, it has been found that electroless nickel provides a suitable base for the tungsten. However, it is necessary to modify the standard plating bath formulation and to prepare the carbon surface properly to obtain a satisfactory deposit.

Preparation of the Carbon Surface

Overcleaning must be avoided or a smut will be produced which makes the plating more difficult. An effective cleaning is produced by immersion in trichlorethylene vapor for a few minutes; however, if this fails, the surface can be cleaned by rubbing with a clean cloth, being careful to avoid touching the surface with bare hands.

After cleaning, the surface must be activated. This may be effected by wrapping iron wire around the part, or by placing the carbon parts on an iron wire screen in the electroless nickel bath. Activation is essential in order to start the plating action; once it has started, coverage proceeds at a slow rate until the carbon surface is completely coated with nickel, after which the plating rate increases rapidly. To act as a base for tungsten flame plating, a minimum thickness of about 0.001" is required, which is produced in approximately four hours. However, for other applications, the time can be adjusted accordingly, of course.

Nickel Bath and Operating Procedure

The electroless nickel solution modification for carbon is prepared as follows:

1.	Water	10 gal.
2.	Nickel chloride	5 lbs.
3.	Sodium citrate	8 lbs.
4.	Sodium hypophosphite	1 lb.

The water is heated to about 150°F. and the chemicals added in the above order. When the salts have been dissolved completely, the temperature is raised to a slow boil and maintained at boiling during the plating operation. As the reaction slows down, one ounce of sodium hypophosphite is added at a time until the rate again increases. When the desired thickness of deposit is obtained, the parts are rinsed well and dried thoroughly.

Science for the Coatings Technologist

By E. S. Beck

This is the second and final installment of Part XII. The first part appeared in the January issue.—*Ed.*

Mercury Compounds

THESE are the most widely used, most free from drawbacks, and most highly efficient of the presently available mildewcides. These compounds are based on the mercur*ic* form of mercury, which is a universal poison to all forms of life. Mercur*ous* mercury, as in the old remedy calomel, is non-toxic.

Mercury compounds for paint use as mildewcides are practically all prepared as phenyl mercury derivatives. Originally, the phenyl mercury oleate and phenyl mercury naphthenate were used. These are more or less replaced by other compounds, which have been shown to have greater efficiency.

One of the most widely-used materials is di(phenyl mercury) dodecenyl succinate. The material as sold (in hydrocarbon solvent solution) runs 10% mercury by weight. The average quantity recommended for normal paints is 0.5% based on total paint weight. As little as 0.25% or as much as 2.0% may be needed, depending upon circumstances.

This material is quite an efficient mildewcide, showing all the advantages of the phenyl mercuric compounds, with certain additional advantages such as solubility in paint vehicles, availability in liquid form, non-crystallizing character and stability in aliphatic hydrocarbon solvents.

The principal value of the mercuric compounds lies in their extreme efficiency. Smaller amounts are required than for any other material. In general, 0.05% of mercury, based on the total weight of paint, will do an acceptable job. Where conditions are extreme or the basic formulation is very susceptible to mildew, larger amounts will be necessary.

Mercury compounds are possessed of other useful characteristics also for application as mildewcides They are, in general, non-volatile, insoluble in water, and, in the quantities used, of no activity on the paint film. They do not impede drying, plasticize nor discolor the film, or make their presence known in other undesirable ways.

There remains the problem of human toxicity. Theoretically, because of its extremely toxic nature, mercury would be an undesirable material to work with or to have present in a paint film. Actually, experience has shown that, with suitable precautions, the problem can be controlled completely.

The question of toxicity must be viewed from two aspects: the hazard to the batch-maker in the paint factory and that to the user of the paint. It would seem that the only real hazard is encountered by the batch-maker. He is working with compounds running 10% or higher in mercury content. A large measure of vigilance is necessary to avoid dangerous situations.

To begin with, people handling phenyl mercuric compounds should wear impervious gloves to protect the skin from contact with the solution. Splashes or spills should be avoided; and energetically cleaned up if they occur. And the hands and skin should be kept scrupulously clean to avoid any possibility of ingestion of the material.

The most common danger is that of skin irritation from the material. Appropriate treatment as soon as symptoms appear will usually manage to keep such irritations under control. There will always be a small percentage of people who react violently when exposed to contact with mercury compounds, as there are people who are sensitive to other active substances.

The other form of danger: to the user of the paint, is slight indeed. Many toxicological tests have been run to demonstrate this. We can look briefly at a summary of data from a test series by the General Microbiological Laboratories on a commercial mildewcide.[2] All tests were conducted on rabbits.

The presence of up to 2% of the mercurial caused slight reddening of the skin, but no more irritation than the control paint without it, or of plain mineral spirits solvent. From which we can conclude that in amounts up to 2% there is usually no skin-irritancy.

When the rabbits were fed the paint solids containing 2% of the mildewcide, they showed only minor symptoms and all survived. Amount fed was 24 grams in a two-week period. This would correspond to ingesting the solids from a quart of the paint in the case of a 150-lb. man. It can be concluded from this that the presence of the mercury is not a matter for serious concern, for most individuals from a toxicity point of view.

Mercury is used in other forms than the phenyl mercuric compounds, but these are of definitely lower efficiency. An example is mercuric chloride, which is rated by Hunt[1] in the same category as chlorinated

phenols, or perhaps ¼ to ½ the effectiveness of phenyl mercuric compounds. Many other materials have been proposed or are in limited use, such as pyridyl mercuric compounds, merthiolate, etc. A widely-used blend of phenyl mercuric acetate and potassium trichlorophenate, will be taken up under phenolic compounds.

Copper Compounds

Copper is another universal protoplasmic poison, although not nearly so powerful as mercury. In the form of copper flake or the oxide, it has been used for a long time to discourage barnacles from attaching to the bottoms of ships. In all its forms and preparations it shows at least some degree of mildewcidal activity.

Copper oxide is an old and valued mildewcide for outdoor paints. Its drawbacks have been several. To begin with, its efficiency is relatively low. Substantial amounts are required, in comparison with other materials. Secondly, it produces a marked discoloration in the film, making it unsuitable for white or many pastel colors. Any mildewcide which cannot be used for inside or outside white is indeed, one of very restricted utility in the paint world. Finally, it must be ground into the formulation, and cannot be added as a solution to the finished material. This last is not a critical defect, but it is certainly a convenience to have mildewcides in fluid form.

More recently, copper 8-quinolinolate has come into considerable use. This material is an extremely effective mildewcide. Some have picked it as the most powerful of all the common mildewcidal materials. As with most materials in technology, the value of copper 8-quinolinolate varies with the conditions under which it is used. It found great success in the treatment of canvas and rope against rot.

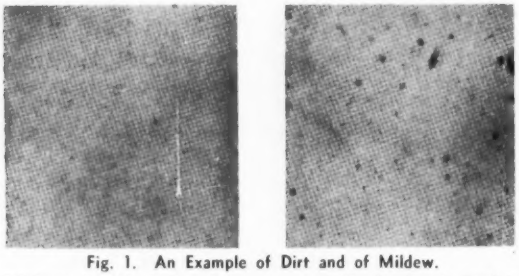

Fig. 1. An Example of Dirt and of Mildew.

Without the aid of the microscope, most discoloration is hard to identify. Even with high-powered magnification, it is not always easy to distinguish mold from dirt. Some spore-bearing structures still will resemble granular dirt. It requires an expert eye plus special illuminating conditions to clear up the difficult cases.

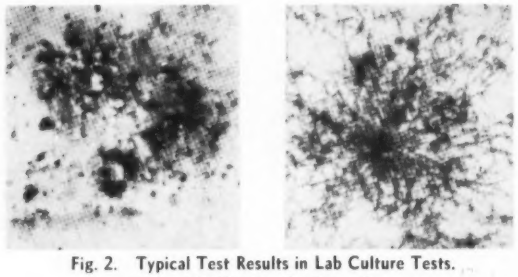

Fig. 2. Typical Test Results in Lab Culture Tests.

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These are illustrations of the accelerated laboratory test for mildew-inhibiting power. In these examples the rating system runs from 0 (no growth) to 10 (very heavy growth). The procedure of the test is described in the article. The center white square is the treated filter paper. The background is the surface of the culture in the Petri dish.

For use in paint, a solubilized form has been preferred. This runs 10% copper 8-quinolinolate. It is quite expensive — in relation to its efficiency — compared to mercury compounds. In fact, at equal efficiency concentrations, the copper 8-quinolinolate will run as much as five or even ten times the cost of a phenyl mercurial. Needless to say, extraordinary benefits are necessary to overcome such a cost drawback.

Copper 8-quinolinolate seems to be one of those materials which show up much better in laboratory tests than they do in actual service. It frequently earns the first place in laboratory evaluations, but it is usually found to be less effective in operating situations. This means that substantially more than would be anticipated must be used in formulating coatings. From 1.0 to 2.0 percent of copper 8-quinolinolate is perhaps the optimum quantity for most coating materials. (This is in terms of dry copper 8-quinolinolate.) About half this amount is needed if the solubilized dispersion is employed (dry weight).

The solubilized form, while more effective, is much more expensive, so that in the net, it becomes cheaper to use the dry material, even with the drawback of grinding it in.

Like all copper derivatives, the copper 8-quinolinolate has a definite staining action on whites and light shades. The product has a dirty green cast, and is unsuitable for use in most clean shades and white. It is also somewhat reactive with and may produce livering in the presence of zinc oxide.

The chief use for copper 8-quinolinolate in the paint industry at the present time would seem to be in formulations where the use of mercury is to be avoided. These would include certain specification materials, and paints where for real or fancied reasons, the toxicity of mercurials is considered a hazard.

While copper is the principal 8-oxyquinoline derivative to be used as a mildewcide in coatings, there are a few other metallic compounds using other metals, which might be briefly touched on at this point. A solution of phenylmercuric-8-oxyquinoline at one time had a certain following in the paint industry. The material contains 30% phenylmercuric-8-oxyquinoline; and amounts from ½ to 1% based on the total weight of paint are recommended by the manufacturer.

Manganese 8-quinolinolate has also been reported on, but is of relatively low value as compared with the copper compound. 8-hydroxyquinoline itself has a definite measure of mildewcidal activity, but is not nearly so effective as its metallic derivatives.

Phenolic Compounds

These materials constitute a large and widely-used class of mildewcides and rot-preventives. It is true that they are used more frequently in non-paint applications than in protective coatings. The group includes antiseptics, such as carbolic acid, which are rarely if ever used commercially as mildewcides. It also includes creosote, a substance rich in cresols, which is in extremely wide use as a preservative for raw wood.

Phenolic materials, in general, delay the drying of ordinary paints. In fact, they are a popular and effective group of anti-oxidants, used to retard skinning. This same anti-oxidant action will also retard drying. This is one reason why creosote is not more widely used in paints for wood. In addition to inhibiting the drying of paints, creosote (and many other phenolic compounds) also has an objectionable discoloring action.

The phenolic materials most in use as mildewcides today are not simple phenols and cresols, but more complicated in structure. They may be classed into two principal categories: chlorinated phenols and orthophenylphenates. Each is available in a generous variety of derivatives.

The chlorinated phenols have long been valued as preservative agents for lumber, rope, canvas and similar materials. They have also been employed as disinfectants, leather preservatives, preservatives for paper pulp lap stock, as well as for preserving glues, adhesives, and a multitude of other materials.

They are relatively non-toxic, as such materials go, but do show a certain tendency towards producing skin irritations. When working with these materials, care should be taken to avoid inhaling dust, if the chlorinated phenol is in the dry state. And the skin should be protected from contact with concentrated solutions of chlorinated phenols.

The chlorinated phenols are available in two forms: the phenol base, for use in organic solutions and in paints; and the sodium salts, for use in aqueous media. (This classification is true in a general sense, but it must be pointed out that the sodium and potassium salts are frequently used in solvent-type paints.)

In paints, concentrations of around 2-3 percent chlorinated phenols are commonly used for protection. There is a slight camphor-like odor associated with chlorinated phenols, which can be objectionable under some conditions. The trichlorophenol has the most pronounced odor. There is also a noticeable tendency to slow down the drying of many compositions.

As the chlorinated phenols were for so long used in the wood preservation field, it is perhaps natural that they are still most popular in the paint world for coatings intended to protect wood. Perhaps the most well-known use is in wood sealers where 5% of a mixture of chlorinated phenols is required by a government specification. Many other types of coatings for raw wood, or first coats for new wood, use chlorinated phenols as preservatives. In the case of penetrating sealers, the principal function is to protect the wood itself. In subsequent coats, the function is principally to protect the paint from mildew. For both purposes, the chlorinated phenols work quite well.

There are quite a number of different chlorinated phenols which are offered for use as preservatives. In addition to trichlorophenol (two isomeric types), tetrachlorophenol and pentachlorophenol, there are also available a number of related materials such as monochloro phenylphenol (two isomeric varieties) and others.

As far as paints are concerned, it would appear that the tetrachlorophenol is the most active, being better by a small margin than the pentachlorophenol. The differences in activity, however, are not great. There

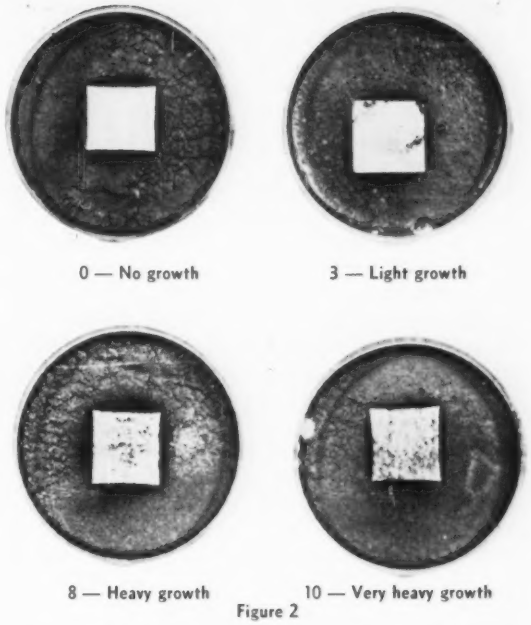

Figure 2

may even be some synergistic action between members of the chlorinated phenol family. At any rate, the use of mixtures instead of single materials is quite widespread.

A related product is the coconutamine salt of tetrachlorophenol. It is recommended for use with wood sealers in concentrations of about ¾%. It is also useful for rot-proofing textiles and cordage. It is very low in toxicity, and less apt to produce dermatitis than the unmodified chlorinated phenols.

In addition to the sodium and potassium salts, such derivatives as zinc and copper pentachlorophenate have been prepared and found to be of value as mildewcides. However, they are not as effective (in laboratory tests) as tetrachlorophenol.

A zinc salt of an alkylated propylene diamine pentachlorophenate is a very powerful mildewcide, comparing favorably with copper 8-quinolinolate on an equal cost basis. It is non-staining, but delays the drying by its anti-oxidant properties.

Orthophenylphenol and its derivatives represent an important class of industrial mildewcides. The straight material itself is an excellent bactericide and mildewcide for use in organic solutions, and its soluble salts are widely used in aqueous solution. It is low in odor and not particularly toxic. About ½ to 1% is sufficient for most paint purposes.

Derivatives of orthophenylphenol such as tetradecylamine orthophenylphenate and the copper and zinc complexes of the base are all recommended for paint mildewcide applications. All have low odor, and are relatively nontoxic. The zinc compound is better in color than the copper, although somewhat lower in mildewcidal activity. It is also lower in skin irritating properties.

In keeping with the ideas of many technical men on the value of mixtures of mildewcides for optimum performance, one of the best known materials now in use is a mixture of a mercurial and a phenolic. It is a mixture of phenylmercuric acetate (10%) and potassium

orthophenylphenate (50%) in a mixture of solvents. The manufacturer declares that organomercurials alone will not provide adequate protection to paint films. The synergistic action of the orthophenyl phenol is essential.

Of course, it can be shown that many paints can be well-protected with mercury alone (in adequate quantity). But it is quite plausible in view of much accumulated evidence that, by means of synergism, both the mercury and the phenolic could operate more effectively. This would result in a lower unit cost for a given degree of protection.

This concludes our discussion of the standard mildewcides. However, there have been two recent developments in this general field which deserve especial attention. Both show unusual features not hitherto available.

The first of these is a new preservative pigment of the barium borate type (specifically barium metaborate monohydrate). It is offered as a preservative against mold (and the dirt which accompanies mold on exposure) as well as an agent for reducing the rate of chalking of white paints. It also decreases the yellowing tendency of certain paint films.

The material is recommended to be used (in zinc-free paints) in the amount of 1.5 to 3.0 lbs. per gallon, depending upon the type of extender which is present. Calcium carbonate extender requires the lower amount. This applies to alkyd or oil type of outdoor paints only. With certain types of copolymer vehicles and with tinting pigments which are unstable in an alkaline medium, unsatisfactory results have been obtained.

The use of this mildewcide enables the formulator to dispense with zinc oxide, which is often a benefit because of its effects on adhesion and because of its liability toward embrittlement in some formulations. The material is not recommended for formulations in which diatomaceous silica provides the principal part of the extender.

In properly formulated paints containing the barium metaborate monohydrate, it is claimed that chalking is retarded with no increase in the tendency to crack. In fact, in calcium carbonate extended exterior paints, a noticeable reduction in cracking was observed. In all cases, where practical formulations were obtained, a good inhibition of mildew was observed.

The price of the material is, at the present time, something of a drawback. Its use results in a definite increase in the raw material cost. Perhaps for premium products it is worth considering for current requirements. For other purposes, most formulators will await a reduction in cost or the establishment of some strongly advantageous properties.

The other new material, is the ingredient which makes possible the so-called self-sanitizing paints. Chemically, it is 2,4 dichloro 6-(o-chloroanilino)-s-triazine. It is available as a free-flowing powder or as a pre-dispersed paste.

In the case of the powder, it must be ground into the formulation as a part of the pigment. The pre-dispersed paste may be added without grinding, to materials which do not require a high degree of dispersion.

It is a remarkably easy substance to use. Simply add to the formulation. In general, from 0.5% to 1.5% is the best range, with acceptable results in most materials being obtained at 1%. The material is compatible with the majority of coating materials. It has a tendency to body excessively and to lose potency in the presence of zinc oxide, so this ingredient should be avoided. It also discolors with cobalt drier. If this is objectionable, manganese or zirconium drier may be used. One further incompatibility lies in its tendency to thicken with casein. In latex paints where casein might normally be used, it is advisable to change to methyl cellulose or other thickeners of this type.

Self-sanitizing paints not only inhibit the growth of molds and bacteria on or within the paint, but also exercise a killing action on bacteria and molds. While this effect can be obtained to an extent with some other materials, nothing which has yet been offered is a self-sanitizing as this product.

This could mean that walls and benches in critical areas such as hospitals, food plants, kitchens, lavatories could be kept almost automatically clean and germ-free with a minimum of maintenance.

Areas which are now painstakingly washed down with germicides or detergents at frequent intervals might now be allowed drastically reduced maintenance. The over-all cleanliness might be greatly improved with such a change.

For such properties to be of commercial value, the coating which is to be self-sanitizing must have an effective action against the most common and more dangerous bacteria. It must retain this activity for an appreciable period of time, preferably months or years. It must be non-toxic in itself. If it resisted frequent washing, its value would be greatly enhanced.

From laboratory data accumulated to date, it would seem that this mildewcide can meet all these requirements. It appears to be relatively non-toxic, based upon animal feeding tests. It shows no skin-irritating properties in the paint film, although the concentrated dispersion is considered to be slightly irritating to the skin if in frequent contact.

Its effectiveness, like that of most bactericides, is excellent against many bacteria, good against others, and relatively ineffective toward still others. It cannot be said that sterile paint surfaces are produced. But it is difficult, if not impossible, to produce and maintain sterile paint surfaces in any practical way.

Films containing the mildewcide do kill most molds and many bacteria, including *Staphlycoccus aureus*. The films also greatly reduce the bacterial count of a wide variety of other bacteria, even though the kill is not complete. Hence the choice of the name *self-sanitizing* (instead of *self-sterilizing*).

The sanitizing property is retained indefinitely in the package. At the end of a year's storage, the sanitizing properties remain unimpaired. Better still is the fact that the sanitizing properties persist even on outdoor exposure. At the end of a year's outdoor exposure, these properties remain substantially unchanged.

Finishes utilizing such a mildewcide can be washed repeatedly with no apparent loss of sanitizing properties. One series of tests included washing with soap and water and a cellulose sponge daily for 80 washings. At the end of this period, the self-sanitizing properties were seemingly unimpaired.

(*Continued on page* 75)

Which Rectifier for Electroplating - - - Silicon or Germanium?

By J. T. Cataldo, *Vice President, International Rectifier Corp., El Segundo, Calif.*

MOST discussions over which rectifier to use in electroplating applications — germanium or silicon — end in a stalemate. Every design engineer has his particular preference and biases, and it is said that particularly in plating, one can find as many reasons for using silicon as he can for germanium.

In addition, there is discernable today a marked trend toward using silicon in any and all applications simply because of its novelty and because of the extensive publicity this new semiconductor has been receiving. In the main, this trend is due to a "when in doubt, use silicon" philosophy that stems from the mistaken idea that silicon will do all that germanium will do, and provide a wide safety factor as well.

The fact is that no one rectifier is a general panacea; there are applications where silicon functions best and others that distinctly call for germanium. Thus, in electroplating applications, if a careful analysis is made, comparing and evaluating both types of rectifiers down the line for plus and minus factors, it soon becomes clear which unit has the advantage in this particular field, especially for the user of the equipment.

Before a proper evaluation can be made, there are a number of factors to be considered. Table I shows some of the more important points to be evaluated.

AMBIENT TEMPERATURES:

Electroplating applications generally do not require high temperature devices, consequently, either silicon or germanium is applicable. However, in referring to Table I, it will be seen that germanium can operate in an ambient to 122°F. while silicon is capable of operation to 320°F. Since electroplating equipment normally must be attended and adjusted for voltage and current output, germanium may be used in any ambient temperature that a human can withstand.

RESISTANCE TO CURRENT AND VOLTAGE SURGES:

Both germanium and silicon require protective devices for surge currents and voltages. Due to the small size of germanium and silicon units, they are operated at a high forward current density, in the order of 75 to 1000 amp. per square inch. Since the forward losses are equal to I^2R, any overcurrent increases these losses rapidly. The problem then is to remove this additional heat as fast as it is developed, or the rectifier will be destroyed. Alternative solutions are to

TABLE I

Comparison Table — Silicon Versus Germanium-Electroplating

Evaluation Factors	*Silicon*	*Germanium*
Ambient Temperature (Max.)	320°F.	122°F.
Resistance /Voltage	Protection Required	Protection Required
To Surges /Current	Protection Required	Protection Required
Leakage at Rated Voltages	Very Low	Very Low
Size	Small	Small
Life	Unlimited	Unlimited
Aging	None	None
Parallel Cell Operation	Good	Good
Cell Operating Temperature Limit	392°F.	149°F.
Environmental Resistance	Hermetically Sealed	Hermetically Sealed
Forward Voltage Drop	1.0 V	0.68 V
Efficiency	90.5%	95.5%
Installation	Good	Excellent

employ overload protective devices, or design the rectifiers (diodes) at a lower value than their current and voltage rating. For conservative, long-life equipment, both overload protection and under-rating of the rectifiers should be employed.

LEAKAGE AT RATED VOLTAGES:

Leakage currents for germanium and silicon rectifiers are phenomenally low. However, it should be pointed out that, except for special applications such as magnetic amplifiers, these low leakages are of negligible importance, especially in electroplating installations.

CURRENT UNBALANCE:

When more than one junction in parallel is required, current unbalance due to semiconductor resistance and voltage drop must be considered. This unbalance may be equalized readily in both germanium and silicon rectifiers with balanced circuits. Figure 1 shows a typical example for balancing diodes in parallel by the use of paralleling reactors to assure equal current distribution.

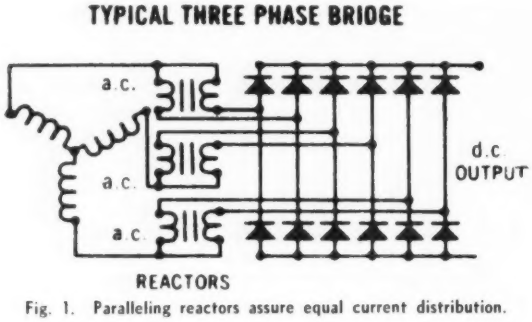

Fig. 1. Paralleling reactors assure equal current distribution.

ENVIRONMENTAL RESISTANCE:

Both silicon and germanium units are small in size and lend themselves easily to hermetic sealing. Thus, they are impervious to contaminants, and will readily withstand such adverse environmental conditions as humidity, salt spray, or other industrial contaminants.

EFFICIENCY:

To the user in a plating operation, the most important consideration is how he may obtain optimum operation at his particular voltage levels, while assuring economy in both initial and operating costs. Consequently, power efficiency is a prime consideration. The voltage drop in each diode is directly proportional to the load. This characteristic voltage drop, therefore, is proportional to the operating efficiency of the diode. Since both germanium and silicon experience minimum voltage drop as compared to other types of rectifiers, it now remains to discover which of the two is most stable.

Referring to Table I, it will be noted that germanium has a forward voltage drop of 0.68 v., while silicon has a drop of 1.0 v. Thus, if we consider a 10,000 ampere anodizing unit operating at about 30 volts output, we find that a germanium rectifier will require a three phase bridge with a 6-1-7 or a 6-1-8 connection. Rectifier losses on this configuration would be about 16 kw (960 kwh per 60 hour week), or about a 95.5% efficiency. An equivalent silicon unit would use a 6-1-8 connection, with total rectifier losses of about 31.3 kw (1872 kwh per 60 hour week), or about a 90.5% efficiency.

To illustrate, a 10,000 ampere germanium power supply operating 10 hours a day, six days a week, will save 912 kwh per week over a silicon unit of the same rating. At an estimated national average cost of $0.02 per kwh, germanium junctions in this application will result in savings of $948.48 per year over a silicon unit. Naturally, if the power cost is higher, there is a greater saving.

LIFE:

Theoretically, both germanium and silicon do not exhibit any aging effect with many thousands of hours of operation, indicating an extremely long life. However, this theoretically "long life — no aging characteristic" cannot be achieved unless the equipment design engineer takes into consideration the design factors of the particular rectifier together with the application of the overall equipment.

INSTALLATION:

Silicon units usually take the form of diodes which must be provided with a suitable heat sink for proper operation. If liberties are taken in choosing a less efficient heat sink, malfunction and eventual burn-out of the diode is certain. Germanium, on the other hand, is usually provided as an integral unit with its own specially designed heat sink.

Conclusions

Based on the above evaluation, it is the author's opinion that germanium is the best rectifier for electroplating applications. It offers many advantages, one of which cannot be ignored by the user — the power saving. This saving can be substantial regardless of the size of the installation.

Although many discussions are carried on as to the merit of one rectifier over another, it is the opinion of the writer that neither germanium or silicon will obsolete the other as a rectifier. Nor will they obsolete other types of rectifiers. Like all new products, they each have their particular niche in the vast field of electrical engineering. A perfect example is selenium. When this rectifier was developed, it did not replace copper oxide or magnesium-copper sulphide rectifiers. More copper oxide rectifiers are being produced today than when selenium was first introduced. Both of these older rectifiers are still being manufactured and used today, although selenium has been in production for some 20 years or more in this country.

In today's industrial world, where new uses are constantly being found for both new products and old products, there is little to worry about with the obsolescence of any one product. The decision of what type of rectifier to use in a particular job of application is up to the design engineer as well as the component manufacturer. With the proper evaluation of design factors and component characteristics, the best rectifier for the application will be used.

Science for Electroplaters

44. AMIDES

By L. Serota

AMIDES represent a class of compounds in which the OH group of an organic acid, R-COOH is replaced by the amino group, $—NH_2$. The general formula for an amide, therefore, is R-$CONH_2$. The R-CO group is known as the acyl group. The name of an amide is based upon the name of the corresponding acid, such as formamide, HCO-NH_2 (from formic acid, HCOOH), or acetamide, CH_3CONH_2 (from acetic acid CH_3-COOH). Amides are solids with the exception of formamide, which is a liquid with a boiling point of 193°C.

Formamide

Formamide has been the basis of study as a solvent for the electrodeposition of metals because its physical characteristics and constants are quite similar to those of water. *L. F. Yntema* and *L. F. Andrieth* note the following properties of formamide: The dielectric constant of formamide is increased over that of formic acid; the solvent properties, yielding conducting solutions, are improved; it is miscible in all proportions with alcohol; metallic derivatives relating to formamide compare in properties (such as solubility) with metal hydroxides and water; formamide is a good dissociating solvent and bares a close relationship in the conductivity of dissolved salts to that of water solutions of such salts. *M. E. Cupery* reports that sulfamic acid, NH_2SO_3H, is soluble in formamide. The solubility data show that 20 grams of sulfamic acid will dissolve in 100 grams of formamide at 25°C.

Early investigations of electrodeposition of metals from solutions of salts in formamide were made by *Rohler*. Deposition of metals was attained from the following salts, exhibiting the properties of electrolytes: copper sulfate, copper chloride, lead chloride, zinc chloride. Anodes were of the same element as the metal to be deposited. Deposits were not obtained from chloride solutions of magnesium, aluminum, nickel, cobalt, and iron. Losses at the anode were greater than the gain in weight of deposited metal, a condition attributed to the formation of metal formamide and free acid. The rate of dissolution was reduced by excluding air. Yntema and Andrieth, in a continuation of this study, report results shown in Table I.

TABLE I
Electrodeposition of Metals from Formamide Bath at 100°C.

Compound	*Grams Solute per 15 cc. Solvent*	*Current Density amp./cm.²*	*Type of Deposit*
$Zn(CN)_2$	0.5	0.03	Adherent deposit
$Cd(CN)_2$	1.4	0.02	Smooth, adherent deposit
$Pb(NO_3)_2$	3.0	0.03	Non-adherent
		0.06	Crystalline, adhered in spots
SnI_4	1.0	0.04	Smooth, adherent
$(NH_4)_2SnCl_6$	2.0	0.04	Excellent deposit
$Co(C_2H_3O_2)_2 \cdot 4H_2O$	2.0	0.02	Poor deposit
		0.05	Better deposition-adherent
$Ni(C_2H_3O_2)_2$	sat'd.	0.018	Fair, adherent deposit
$Ni(NH_3)_6Br_2$	2.0	0.025	Good, adherent deposit

The solutions were stirred. A one square centimeter platinum anode and a copper cathode served as the electrodes. The odor of hydrogen cyanide was evident when cyanide solutions were used. This hydrogen cyanide formation was ascribed to the solute reacting with the solvent. Rohler had previously made this observation. The following equation for this chemical change is given:

$$Zn(CN)_2 + 2HCONH_2 \rightarrow Zn(CONH_2) + 2HCN.$$

The deposition of metals from fused acetamide under conditions similar to those used for formamide was also investigated by the authors. Good deposits were obtained with cadmium, tin, cobalt and nickel. It was also found that metals higher than zinc in the electromotive force series could not be deposited from solutions with these solvents.

R. B. Blue and *F. C. Mathers* investigated the electrodeposition of aluminum, as an alloy with iron, from a solution of aluminum chloride and ferric chloride in formamide. Satisfactory results were obtained from a bath containing a high concentration of iron. The composition of the bath used is as follows: ferric chloride 0.5 g.; aluminum chloride 1 g.; formamide, 30 cc. Operation was conducted at room temperature, at a current density of 1.5 amp./dm.² Aluminum anodes and copper cathodes were employed. After a 5 hour run, the deposit was thick, adherent, finely crystalline, and silvery. Tests showed the presence of aluminum in the deposit. The fresh alloy deposit decomposed water, liberating hydrogen, but exposure of the deposit to air stopped the activity of the metal. Rust spots appeared when the metal was exposed to moist air for several hours. Analysis of several deposits plated on platinum gave the results shown in Table II.

M. R. Zell refers, in METAL FINISHING, to the use of formamide, in a patented process for depositing chromium from a trivalent (chromium salt) bath. Previous efforts to plate from a (trivalent) chromium sulfate bath, using addition agents such as magnesium sulfate and a sulfite were found to be

TABLE II
Aluminum-Iron Alloy Deposits

Total Weight of deposit in grams	*Weight of Iron in Grams*	*Weight of Aluminum in Grams*	*Per cent Iron*	*Per cent Aluminum*	*Total Per cent*
0.1342	0.1260	0.00712	5.31	93.14	98.45
0.0346	0.03094	0.003594	10.39	89.42	99.81
0.08467	0.0697	0.01459	17.65	82.22	99.87

unsatisfactory. A bath containing chromium sulfate with ammonium sulfate showed promise, but the solution gave very poor covering power, as the deposits were uneven, showing cracks, and had an unattractive non-metallic gray color.

The addition of large quantities of urea, $CO(NH_2)_2$, to this latter bath, it was found in 1952, gave a bright smooth deposit with fairly good covering power. A patent for the use of urea in a chromium sulfate bath was issued to *T. Yoshida* in 1955. It was found, however, that this type of bath gave a brittle deposit as well as showing a tendency to flake off, so that heating after plating, to correct brittleness and stress of the chromium, was not practical. Zell found that the addition of a small amount of formamide (3-20 ml./l.) to a solution of chromium and ammonium sulfate gave smooth, nearly bright, and ductile deposits. The further addition of urea served to keep the salts in solution and reduce the formic acid resulting from the hydrolysis of formamide at the higher temperatures necessary to keep the salt in solution. Operation at temperatures of 80-100°F. was thus possible with urea present. Some loss of ductility, it was indicated, results from the addition of urea.

The bath recommended consists of chromic sulfate 300-400 g./l.; ammonium sulfate, 200-300 g./l.; urea, 300-400 g./l.; formamide, 3-20 ml./l. Excess formamide tends to darken the deposit. The occasional addition of small amounts of sulfuric acid controlled the slight hydrolysis of urea. Optimum pH conditions have not as yet been established.

Anodic arrangement that gave best results was obtained by using a porous pot for the bath, surrounded by an anolyte of sulfuric acid with lead inserted as an anode. Current densities ranged from 10-50 amp./dm.^{2}, which compare favorably with that of the chromic acid bath. Throwing power and covering power are reported to be equal or superior to the chromic acid bath.

Some of the favorable aspects indicated for deposits from a trivalent chromium bath include the following: elimination of harmful chromic acid spray and mist does away with the need for an exhaust system; codeposition of metals which are soluble in chromic acid is possible; the presence of small amounts of iron in the formamide type solution was found to improve the brightness of the deposit; low concentrations of nickel, cadmium, manganese etc., appear to alloy easily with the chromium deposit; the chromium deposit from this bath exhibits a high resistance to cold hydrochloric acid, a characteristic believed to be due to the presence in the deposit of some cathodic reduction product of formamide or the other constituents.

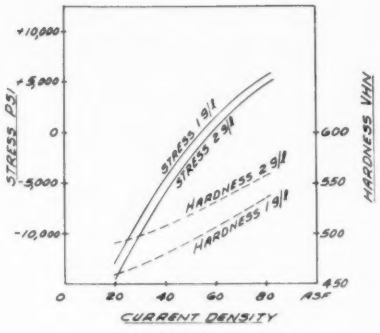

Fig. 181

Sulfonamides

The effect of paratoluene sulfonamide, p-$CH_3C_6H_4SO_2NH_2$, as an addition agent, on the hardness and residual stress in nickel deposits from a nickel sulfamate bath, at temperature ranges of 90°-130°F., and current densities from 20-30 amp./ft.^{2}, was investigated by *I. L. Newell.* Because of the limited solubility of paratoluene sulfonamide in the sulfamate plating bath, less than 3 g./l. was added at 90° and 110°F. and a concentration of 3 g./l. of the addition agent was possible at 130°F. The bath composition included: nickel sulfamate, 250 g./l.; sodium chloride, 10 g./l.; boric acid, 15 g./l.; sodium lauryl sulfate, 15 g./l.; pH at 25°C., 5.0. Purification with activated carbon and dummying was included in the bath preparation.

Measurements of ductility by noting the angle of bend to fracture, were made on ½ inch by 6 inch panels. Results were not recorded in the report. A Tukon hardness tester and a Knoop indentor, with frequent rechecks with a Vickers diamond, were used for hardness measurements on 4 inch by 6 inch panels. For stress measurements the Brenner-Senderoff contractometer was employed. Measurements were made on nickel deposits 0.005 inch thick. Results of such measurements at a temperature of 90°F. are shown graphically in Fig. 181. It will be noted, for example, that a sharp increase in stress occurs with increased current density, while hardness is not appreciably affected by changes in current density. At the higher temperature of 130°F., however, changes in current density do not change the stress, so that the psi values remain almost constant. As evidence, data for a 1 g./l. concentration of paratoluene sulfonamide in the bath at 130°F. indicates that the stress (psi) changes but slightly from —7500 at 20 amp./ft.^{2} to —8000 at 80 amp./ft.^{2} Hardness, moreover, is affected by temperature rather than current density of 40 amp./ft.^{2} at 90°F., but a Vickers value of only 437 is possible at the higher temperature of 130°F. and a current density of 50 amp./ft.^{2} The hardness levels off at about 110°F.

Urea

This compound, $CO(NH_2)_2$, also known as carbamide, is the (di) amide derivative of carbonic acid, H_2CO_3. Earlier in this article reference was made to its use in a bath for depositing chromium from a urea — formamide solution. *F. L. Scott* referred to the wide application of urea — formaldehyde, a thermosetting resin, for decorative and protective finishes with plated and unplated pieces. In a study of the use and effects of addition agents in an acid copper electrotyping solution, as a means of overcoming the difficulty of producing soft copper deposits when conditions favorable for rapid deposition are introduced, *R. O. Hull* and *W. Blum* investigated the value of urea for such a purpose. It was found that a solution containing 1 g./l. (0.13 oz./gal.) of urea gave a smooth initial deposit which was soft and coarsely crystalline. After several hours of plating, a hard and fine grained deposit was obtained, indicating, the authors imply, the formation of a secondary product as a phase of its effectiveness as an addition agent. The solution, however, did not yield a smooth or hard deposit after several days. Similar results were gained when the concentration of urea in the solution was increased to 5 g./l. (0.67 oz./gal.). The need of frequent replacement of urea in the solution is noted as a contributing cause to its limited use commercially for electrotyping.

Thiourea

Thiourea (Thiocarbamide) $(SC(NH_2)_2$, is the sulfur analog of urea. In the automobile industry the method of providing a polished copper

surface, as an undercoat for a bright nickel deposit, by a buffing process, entails a loss of metal, which *F. L. Clifton* and *W. M. Phillips* estimate to be about 625 tons of copper on a yearly production of 2,000,000 cars. This problem led to their investigation of the use of an adequate brightener in the acid copper bath, so that this loss could be reduced materially. It was found that the addition of small amounts of thiourea to the standard bath was superior to large groups of addition agents for producing a bright copper deposit. The addition of a second agent, such as an aromatic sulfonic acid (a salt of a sulfonated ether) seemed to be beneficial in producing a uniform, bright deposit over a wide range of current density without possible streaking. Temperature control was found to be important. For example, an increase in bath temperature from 80°F. to 100°F. will destroy most of the brightening effect of the deposit. At 120°F. the effectiveness of the addition agent is lost completely. The optimum temperature for a uniform, mirror bright deposit was found to be 55°F. The concentration of thiourea at this temperature was 0.03-0.45 g./l. With agitation, a current density of 48 amp./ft.^{2} was permissible without burning or treeing.

The addition of molasses, it was found, reduced possible striations in the low current density area without decreasing the brightness of the deposit; hence, buffing was unnecessary. A bath formula used contained $CuSO_4 \cdot 5H_2O$, 210 g./l.; H_2SO_4, 30 g./l.; molasses, 80 g./l.; thiourea, 0.04 g./l.; temperature 70°F.; current density 70-75 amp./ft.^{2} Runs indicated that a bath could be operated for 1000 ampere hours (13,000 gallon tank) without further addition of thiourea.

The maximum concentration of sulfuric acid recommended is 6.6 oz./gal. Higher concentration of acid causes an orange peel effect in the deposit. For a semi-bright bath, 0.01 gram thiourea is the optimum quantity recommended. Greater amounts cause orange peel and striations in the low current density area. Molasses reduces the tendency to striation, producing the opposite effect from thiourea. A large amount of molasses will promote anode polarization, resulting in a falling off of current. The concentration of molasses recommended is 1.0 g./l.

W. Brenner and *C. B. F. Young* also investigated the use of thiourea as an addition agent in the acid copper plating bath. Some of the results of their experiments are tabulated in Table III. The addition of solid thiourea to the bath was found to be unsatisfactory, since a dense white gelatinous precipitate formed, which settled to the bottom of the tank. When added as a dilute solution, some gelatinous precipitate forms. This precipitate, however, redissolves upon agitation of the solution. Reprecipitation occurs on standing, and copper is shown, by tests, to be present. *I. H. Hendricks* expresses the view the rearrangement to the tautomeric imide of thiourea will result, preciptating the cuprous copper as the mercaptide. Tautomerism (Greek, tauto = the same) refers to the change wherein a compound, under certain conditions, changes from one structural form to another (interconvertible), thus showing the reactions of two compounds. Hendrick also considers both addition agents, thiourea and molasses, as acid inhibitors.

TABLE III
Thiourea in Acid Copper Baths

Run No.	Concentration g./l.	C.D. amp./ft.^{2}	Deposit
1	0.00	15	Pink, smooth, fine grained, ductile
		25	Easy to strip, adherent
		45	
2	0.01	25	Very bright, smooth, fine grained, adherent
		45	Some loss of ductility, increase in hardness, uniform
3	0.02	25	Same as 2; some increase in hardness
4	0.04	25	Mirror bright, especially at 65°F., smooth, fine grained, some brittleness
5	0.06	25	Bright deposit (less than above), increased brittleness and hardness
6	0.08	25	Less bright; more brittle, coarser grain, less uniform, more streaks at higher current density
7	0.10	25	About same as 6
8	0.14	25	Same as 6; more streaks
9	0.20	25	Some brightness; coarser grain; more brittle, streaks
10	0.30	25	Rough; more brittle, difficult to strip
11	0.50	25	Salmon colored deposit, not smooth or fine grained
		45	Streaks; brittle; peeling

Air agitation discontinued with run 9.

L. Packman and *A. T. Marinaro* list the formula for a patented process for bright copper plating in which dextrin is used as the second addition agent. The formula is: $CuSO_4 \cdot 5H_2O$, 28 oz./gal.; H_2SO_4, 8 oz./gal.; thiourea, 0.0013 oz./gal.; dextrin, 0.0013 oz./gal.; conc. HCl, 0.0016 oz./gal.. Operating conditions include: temperature, 60°F.; voltage, 1-4; current density, 20-50 amp./ft.^{2}.

E. B. Saubestre includes thiorea in the classification of organic compounds that are suitable as brighteners of the second class for bright nickel baths; and *F. A. Lowenheim* cites two patented formulas for immersion tinning of copper or copper alloy, with thiourea as one of the reagents. Thiourea, it is believed, increases the dissolution of the copper basis metal by complexation of the copper ions. One of the two processes, patented by *J. C. Bradley*, operates at room temperature; the other, patented by *J. D. Sullivan* and *A. E. Pavlish*, operates at elevated temperatures, ranging from 122°F. to boiling. The respective bath formulas follow: (a) stannous chloride, 0.7 oz./gal.; thiourea,, 6.7 oz./gal.; sulfuric acid, 2.7 oz./gal.; room temperature; immersion time 5-30 minutes; (b) $SnCl_2 6H_2O$, 1.3-2.7 oz./gal.; $CS(NH_2)_2$, 11-12 oz./gal.; HCl, 1.3-2.7 oz./gal.; temp. 122°F. to boiling, immersion time 5 minutes. The thickness of the tin deposited for each bath at various periods of immersion is given in Table IV.

TABLE IV
Thickness of Tin Coatings

Time of Immersion	a	Coating Thickness mils b
1 min.	—	0.024
2 min.	—	0.037
3 min.	—	0.047
4 min.	—	0.053
5 min.	0.008	0.060
15 min.	0.015	
30 min.	0.018	
24 hrs.	0.125	

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Electroforming Doll Molds

Question: We would like to get information of electroform molds, which are used in the toy industry. As a rule these molds are used to make doll heads. These are thin shelled, hollow molds made by plating over a wax or plaster form. The molds are heated and slushed with plastisol to make a doll head. I would like to know what materials are used to make these molds and as much technical information as you can give me on the subject.

G. B.

Auswer: Doll molds are produced by first spraying a conducting silver film over the model, using a special double-nozzle stainless steel spray gun and solutions similar to those employed in the production of silver mirrors.

After the surface of the model has been made conductive, about 1/8" of copper is deposited from a copper sulfate or fluoborate plating bath, to produce the slush mold.

The silver conducting film can also be applied by immersing the model in a suitable mixture of silver solution and reducer. Information on solutions for silvering and plating will be found in the METAL FINISHING GUIDEBOOK and in "Metallizing Non-Conductors" by S. Wein.

Testing Oxide and Phosphate Films

Question: Some years ago someone proposed a test for black oxide coatings on steel, using copper sulphate and acids, and measuring the time interval it takes for the oxide to dissolve and for the copper to deposit by immersion on the steel.

Would you be able to locate this information or tell us where we might locate it? We would also like to know who proposed this test.

M. W.

Answer: Our records show that the acid copper sulfate test has been suggested for phosphate coatings but not for black oxide films on steel, although we see no reason why it should not be suitable for the latter also. The solution consists of the following for zinc phosphate films:

10% copper sulfate sol'n.	40 ml.
10% sodium chloride sol'n.	20 ml.
0.1% hydrochloric acid sol'n.	1 ml.

For manganese type films, 130 ml. water are added to the above.

A drop is applied to the surface and the time noted for the blue color to change. The test was suggested by G. V. Akimov & A. A. Ulyanov in the journal of the U.S.S.R. Academy of Science (Moscow), 117-9 (1946).

A suggested test for caustic black oxide films was described by J. Doss in METAL FINISHING, *53*, 48 (Dec. 1955), consisting of application of 3 drops of 5% oxalic acid solution. On a poor quality coating the color changes from black to light grey in 30-90 seconds. On borderline quality films the change is to charcoal grey in 1-3 minutes and on good films 3-8 minutes are required for a change in color from black to brown.

Treating Stainless Steel

Question: Could you break down the stainless steel classes further for me? I know they fall under 400 and 300 series, but are there any other designations for stainless steels? For instance, we have a job whose base metal is "Invar," a 36% nickel-iron alloy. To plate silver on it, would you give it a nickel chloride strike? In other words, would iron-nickel alloys be classified under stainless steels.

Also, we get quite a large amount of passivating work, and every once in a while we get pieces of 400 series stock etching in the passivating bath. What I would like to know is why, if it is the same material (and it checks out 400 series), does this happen?

In our shop they check our plating thickness with micrometers. How accurate are they?

J. J. C.

Answer: The 300 series stainless steels contain nickel as well as chromium, while the 400 series are straight chromium steels. If you write to Allegheny-Ludlum Steel Corp., Pittsburgh 22, Pa., they may still have copies of a recent booklet which lists the compositions and characteristics of the various types of stainless steels.

Invar is not a stainless steel, since it does not contain chromium as a major alloying ingredient. A nickel chloride strike is desirable on all alloys containing nickel or chromium, in order to ensure adhesion of subsequent deposits.

Pitting of 400 series stainless steels during passivation is not rare, and is generally due to improper heat treatment of the metal. The addition of about 2 oz./gal. sodium dichromate to the nitric acid passivating solution is of some help but the problem has to be corrected in the heat treating department.

A micrometer is not considered suitable for thin deposits because slight irregularities, such as dirt spots or nodules of electrodeposit, will introduce very large errors in the thickness measurements, even if the tests before and after plating are made at the same place on the article.

Stripping Chromium

Question: We are, at present, hard chrome plating large cylinders of cast aluminum bodies with a steel insert. The aluminum and steel are cast together. One day, the ammeter on the rectifier went out of order and, because of too much current, the plating blistered.

The construction of the cylinders is

such that discourages grinding. To hone so much chrome would be a matter of days per unit. Do you know of any new method of stripping hard chrome which would not attack the aluminum?

H. A. C.

Answer: If you have a sulfuric acid strip, such as employed for removing nickel deposits, this will be suitable if the density is between 50 and 55 deg. Baume. If a chromic acid etching solution is used for preparing steel for chromium plating, this solution may be employed for stripping also. Both solutions are used at 6 volts.

The third method, if neither of the above two baths are available, is to strip in a solution of 4 - 8 oz./gal. sodium carbonate, using reverse current at about 4 - 6 volts. This solution will produce some attack on the aluminum, however, whereas the first two will have no effect on either the aluminum or the steel.

Touching Up Operations

Question: We have been having a great deal of difficulty with our touching up operations. Even when the color and gloss of our touch up lacquer are very good matches of the finish of the parts, the touched up areas frequently stand out undesirably. Also, the touched up areas peel and scratch off easily. How can we remedy this situation?

D. C. L.

Answer: Before applying the touch up coating material, sand down the area so that a feathered edge of coating to metal is obtained. Apply a primer to the sanded area, then re-sand to a level and smooth surface. Apply the final touch up coating, preferably by air spraying.

SCIENCE FOR THE TECHNOLOGIST

(*Continued from page 68*)

We have been concentrating on the bacterial powers of the material without much attention to its mildewcidal value. It is excellent as a wide-range mildewcide. It is doubtful if it will be used very much for exterior mildewproofing of paints, however. The cost is quite high, and effective production can be obtained in house paints at a much lower cost.

Where the sanitizing properties are desired, the premium price which will be necessary would seem justified; as there is no other way to obtain these properties at this time.

References

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Dow Chemical Company: Dowicide Preservatives in the Paint and Varnish Industry (1956).

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Nuodex Products Company: Special Report on Nuozene Paste for Self-Sanitizing Paints (1958).

Photos courtesy of Nuodex Products Company.

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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Cleaning Machine

U. S. Patent 2,838,289. *June* 10, 1958. *L. L. Northrup, Jr.*

A cleaning machine including: a tank having a bottom and walls extending upwardly from the walls, a horizontal baffle movable horizontally to close the tank, a bay secured to the tank and extending horizontally therefrom for receiving said baffle when it is in open position; means for agitating liquid in the tank; means for moving said baffle between an open position wherein it is disposed in said bay and a closed position wherein it closes said tank; and means for holding liquid in said bay and over said baffle.

Spray Coating Machine

U. S. Patent 2,838,025. *June* 10, 1958. *F. E. Miller, Jr. and D. H. Skinner, assignors to Owens-Illinois Glass Co.*

Apparatus for use in spray coating articles, comprising workholders each in the form of a rod, a plurality of article holding devices mounted on each rod and spaced at intervals lengthwise thereof, a feed conveyor comprising means for supporting the rods in parallel relation and spaced at intervals lengthwise of the direction of travel of the feed conveyor, means for driving the conveyor and thereby bringing the rods in succession into line with a spraying zone, and means for moving each rod lengthwise off the feed conveyor and into the spraying zone.

Spray Coating Method

U. S. Patent 2,839,425. *June* 17, 1958. *J. W. Juvinall, assignor to Ransburg Electro-Coating Corp.*

A method of coating the surface of an article, comprising moving the article over a predetermined path with its surface presented to receive three annular sprays of coating material capable of producing on such surface parallel bands each having two transversely spaced portions of maximum thickness, said sprays being spaced from each other laterally of the path of article movement, two of said sprays having approximately equal diameters smaller than the diameter of the third spray, with all of said sprays being so disposed transversely of the article-path that the individual bands they respectively produce partially overlap each other to produce a composite band having a width greater than but less than twice the width of any individual band.

Stabilized Varnishes

U. S. Patent 2,838,412. *June* 10, 1958. *R. E. Werner and T. A. Langstroth, assignors to Sterling Drug Inc.*

A composition containing a varnish and a nitrophenylazo pigment and including: benzotriazole, whereby the composition is stabilized against discoloration by contact with iron in the presence of small amounts of water.

Shot Blasting Chamber

U. S. Patent 2,839,338. *June* 17, 1958. *T. A. Arnold, assignor to William H. Mead.*

In a chamber of the kind described, a substantially horizontal collector floor comprising a large number of relatively small downwardly convergent receptacles of hopper-like form arranged side-by-side in closely spaced relationship and having their upper ends communicating freely with the interior of the chamber.

Dull Fused Tin Coating

U. S. Patent 2,839,437. *June* 17, 1958. *J. M. Manko, assignor to Jones & Laughlin Steel Corp.*

A method of producing a dull finished fused tin coating on electrolytic tin plate comprising applying to the matte tin coating a dilute aqueous solution of an oxidizing agent selected from the group consisting of alkali metal nitrites, alkali metal nitrates, alkali metal chlorates and hydrogen peroxide, and mixtures thereof, drying the solution on the tin coating, then heating the tin coating to a temperature sufficient to flow the tin, and then quenching the tin plate so as to solidify the tin coating.

Protective Coating for Tin Plate

U. S. Patent 2,839,428. *June* 17, 1958. *A. N. Laubscher, assignor to U. S. Steel Corp.*

A method of inhibiting oxidation of a tin surface comprising applying thereto a coating of a liquid polymer of polyalkylene glycols having a viscosity of less than 500 centipoises at 25°C., a vapor pressure less than 10 mm. of mercury at 227°C., a molecular weight of about 625 and effective to impart to said surface a coefficient of friction less than about .3.

Bright Nickel

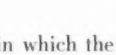
U. S. Patent 2,839,456. *June* 17, 1958. *D. G. Foulke and O. Kardos, assignors to Hanson-Van Winkle-Munning Co.*

About 0.1 to about 10 grams per liter of a heterocyclic organic compound of the group consisting of 2-(4-pyridyl) ethyl sulfonic acid and the alkali metal, magnesium, ammonium, and nickel salts thereof, and from about ¼ to about 80 grams per liter of a water-soluble sulfo-oxygen compound of the group consisting of unsaturated aliphatic sulfonic acids, mononuclear and binuclear aromatic sulfonic acids, mononuclear aromatic sulfinic acids, the alkali metal, magnesium, ammonium, and nickel salts of said acids, and mononuclear aromatic sulfonamides and sulfonimides.

Bright Nickel

U. S. Patent 2,839,457. *June* 17, 1958. *D. G. Foulke and O. Kardos, assignors to Hanson-Van Winkle-Munning Co.*

About 0.01 to about 1 gram per liter of an aromatic N-oxide compound possessing a polar nitrogen-oxygen bond having the structural formula



in which the nitrogen atom forms part of a heterocyclic ring, and from about ¼ to about 80 grams per liter of a water-soluble sulfo-oxygen compound of the group consisting of unsaturated aliphatic sulfonic acids, mononuclear and binuclear aromatic sulfonic acids, heterocyclic sulfonic acids, mononuclear aromatic sulfinic acids, the alkali metal, magnesium, ammonium, and nickel salts of said acids, and mononuclear aromatic sulfonamides and sulfonimides.

Anodizing Aluminum Coated Steel

U. S. Patent 2,839,455. *June* 17, 1958. *H. La Tour and D. C. Perry, assignors to Armco Steel Corp.*

A process of anodizing ferrous articles having an aluminum coating of substantially 0.001 to 0.002 inch thickness which comprises making said articles the anodes in an electrolyte having an oxidizing effect under electrolytic conditions, having a temperature of substantially 160° to 212°F. and employing an initial current density of at least substantially 200 amperes per square foot and a time of treatment of substantially 15 to 60 seconds, the said electrolyte comprising in water solution an acidic material chosen from a class consisting of acetic, sulfuric, nitric, phosphoric, citric and chromic acids and mixtures thereof, and a base chosen from a class consisting of ammonium, sodium, magnesium and potassium hydroxides and mixtures thereof, the said electrolyte having a pH substantially in the range of 6 to 8.

Bright Nickel

U. S. Patent 2,839,458. *June* 17, 1958. *D. G. Foulke and O. Kardos, assignors to Hanson-Van Winkle-Munning Co.*

About 0.05 to about 5 grams per liter of an organic phosphoric acid of the group consisting of mononuclear and binuclear aromatic phosphinic acids, and from about ¼ to about 80 grams per liter of a water-soluble sulfo-oxygen compound of the group consisting of unsaturated aliphatic sulfonic acids, mononuclear and binuclear aromatic sulfonic acids, heterocyclic sulfonic acids, mononuclear aromatic sulfinic acids, the alkali metal, magnesium, ammonium, and nickel salts of said acids, and mononuclear aromatic sulfonamides and sulfonimides.

Wash Primer

U. S. Patent 2,839,438. *June* 17, 1958. *H. Rosenbloom, assignor to Thompson and Co.*

The combination with a wash primer consisting essentially of lead chromate and a solution in a polar solvent of an hydroxyl-containing polyvinyl acetal and phosphoric acid, of at least one strong mineral acid of the group consisting of hydrochloric, sulfuric and nitric acids, the amount of acid, in percent by weight based on the non-volatile solids content of the primer, being from about 0.04 to about 0.16 percent of HCl, not over about 0.4 percent of H_2SO_4, and from about 0.032 to about 9 percent of HNO_3.

Phosphate Coating

U. S. Patent 2,839,439. *June* 17, 1958. *J. M. Stapleton, assignor to Detrex Chemical Industries, Inc.*

In a method of producing an adherent uniform phosphate coating on a ferrous metal, the steps which comprise spraying said metal with an aqueous solution of alkali metal dihydrogen phosphate, and accelerating the coating action by incorporating into the solution an accelerator consisting of about 0.4 to 0.76% by weight nitrate and about .0002 to .0005% by weight molybdate ions.

Bright Nickel

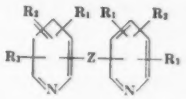
U. S. Patent 2,839,459. *June* 17, 1958. *D. G. Foulke and O. Kardos, assignors to Hanson-Van Winkle-Munning Co.*

The process for producing bright nickel deposits which comprises electrodepositing nickel from an aqueous acidic nickel electroplating solution in which there is dissolved from about 0.005 to about 1 gram per liter of an aromatic heterocyclic carbon-nitrogen compound having a six-membered cyclic nucleus containing from 1 to 3 nitrogen atoms and at least one amino group attached to a carbon atom in a position alpha to the heterocyclic nitrogen, and from about ¼ to about 80 grams per liter of a water-soluble sulfo-oxygen compound of the group consisting of unsaturated aliphatic sulfonic acids, mononuclear and binuclear aromatic sulfonic acids, heterocyclic sulfonic acids, mononuclear sulfonic acids, the alkali metal, ammonium, magnesium, and nickel salts of said acids, and mononuclear aromatic sulfonamides and sulfonimides.

Bright Nickel

U. S. Patent 2,839,460. *June* 17, 1958. *D. G. Foulke and O. Kardos, assignors to Hanson-Van Winkle-Munning Co.*

The process for producing bright nickel deposits which comprises electrodepositing nickel from an aqueous acidic solution of at least one nickel salt in which there is dissolved from about ¼ to about 80 grams per liter of a water-soluble sulfo-oxygen compound of the group consisting of unsaturated alipathic sulfonic acids, mononuclear and binuclear aromatic sulfonic-acids, heterocyclic sulfonic acids, mononuclear aromatic sulfinic acids, the alkali metal, ammonium, magnesium, and nickel salts of said acids, and mononuclear aromatic sulfonamides and sulfonimides, and from about 0.001 to about 1 gram per liter of a bis-pyridyl having the structure



in which Z is a linkage of the group consisting of a carbon-carbon covalent bond, methylene, hydroxymethylene, ethylene, hydroxyethylene, and dihydroxyethylene, and R_1, R_2 and R_3 are substituents selected from the group consisting of hydrogen, methyl, ethyl, and propyl radicals.

Burnishing Machine

U. S. Patent 2,839,876. *June* 24, 1958. *J. J. Murtagh and C. C. Kinker, assignors to James J. Murtagh*

In a machine for finishing articles by the coaction of a rotatable flexible rubbing element and an abrasive-carrying liquid, the improvement comprising a plurality of spaced rotatable work-carrying tables, swinging arm means to mount said rubbing element for movements to cooperate with said work tables successively, means to introduce abrasive-carrying liquid between said rubbing elements and articles carried by said work tables, and means to adjust the extent of swinging movement and thus the operative position of said rubbing element over each of said work tables.

Nickel-Iron-Zinc Alloy Bath

U. S. Patent 2,840,517. *June* 24, 1958. *C. L. Faust and W. H. Safranek, assignors to Rockwell Spring and Axle Co.*

A bath for depositing a nickel alloy electroplate, comprising an acidic aqueous solution of about 17 to 233 g./l. of nickel ions, about 0.3 to 5.6 g./l. of iron ions, about 0.03 to 1.25 g./l. of zinc ions, and a disulfonated benzopyrone in an amount equivalent to about 1 to 10 g./l. of coumarin disulfonic acid.

Paint Spray Mask

U. S. Patent 2,840,039. *June* 24, 1958. *G. Darnell, W. Davis and S. D. Yarm, assignors to Lirita Corp.*

A device for masking prescribed surfaces of a ferrous metal body comprising a rigid masking body molded to conform to at least marginal portions of said prescribed surfaces and includ-

ing plural resin-reinforced laminae, and a number of spaced-apart permanent magnet elements embedded between adjacent laminae along at least one edge of said masking body, the magnetic forces between said permanent magnet elements and said ferrous metal body being effective to maintain said one edge of said masking body in masking contact with said ferrous metal body.

Rack Loader and Unloader

U. S. Patent 2,840,219. *June* 24, 1958. *C. R. Mervyn, R. Listak and H. E. Kaden, assignors to Newart Manufacturing Co.*

In combination with a conveyor of the type having a plurality of arms for suspending work holding racks; the conveyor arms being cyclically indexed past a loading position when the racks are empty; a rack loader, comprising, a base member including a track aligned at one end with the aforesaid conveyor loading position and extending away therefrom to a work loading position; a carriage member mounted on said track and movable longitudinally thereof between said conveyor loading and work loading positions; a bell crank pivotally mounted on the carriage and movable between a first and a second position; and a bracket member mounted on the bell crank and movable thereby through a vertical arcuate path relative to said carriage between a first extended position and a second retracted position.

Corrosion Inhibitor

U. S. Patent 2,840,477. *June* 24, 1958. *D. A. Shock and J. D. Sudbury, assignors to Continental Oil Co.*

A corrosion inhibitor composition consisting essentially on a weight basis of about 0.5 to about 4 parts of a mineral oil, about 1 part of an oil soluble sulfonate inhibitor selected from the group consisting of alkali and alkaline earth metal sulfonates of benzene alkylated with a polymer of propylene, and about 2 to about 20 percent, based on the weight of sulfonate, of an oil soluble polar organic compound selected from the group consisting of amine and metal salts of fatty acids containing from 8 to 24 carbon atoms, characterized further in that the cation of said metal salt of the fatty acids is selected from the group consisting of magnesium and aluminum.

Acid Copper Brightener

U. S. Patent 2,840,518. *June* 24, 1958. *J. W. Condon, assignor to Westinghouse Electric Corp.*

An aqueous electroplating electrolyte comprising as its essential ingredients copper sulfate, sulfuric acid, and from 0.005 to 0.2 ounce per gallon of yeast protein autolysate comprising the digest resulting from yeast acted upon by proteolytic enzymes naturally present therein, said digest being completely soluble and comprising soluble nitrogen compounds.

Protective Coating

U. S. Patent 2,840,478. *June* 24, 1958. *G. O. Orth, Jr. and J. Spinelli, assignors to American Potash and Chemical Corp.*

A protective coating composition, having good surface adhesion characteristics and being resistant to elevated temperatures, comprising in substantially homogeneous admixture, an organic film-forming material, an inorganic coloring material in finely divided form, and from 5% to 15% on the weight of the composition on a wet basis of an inorganic frit consisting of the finely divided production of the fusion at about 370°C. of from about 20 to 50 parts of boric oxide, from about 25 to 60 parts of lead oxide, and from about 1 to about 20 parts of sodium fluoride.

Electrolytic Stripping

U. S. Patent 2,840,521. *June* 24, 1958. *A. Wasserman, assignor to Tiarco Corp.*

A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration less than approximately 15% by volume, said solution being maintained at a temperature below approximately 100°F., and passing current through said solution, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

Lead Anode for Chromium Plating

U. S. Patent 2,840,523. *June* 24, 1958. *W. Cibulskis, M. Shacat and H. Mahlstedt, assignors to Metal & Thermit Corp.*

An insoluble lead anode for a chromic acid chromium plating bath, comprising an upper portion of copper, an elongated lower portion of lead, and an intermediate portion of lead joining the upper and lower portions, the upper portion being integral and having a hook at its upper end and an enlarged conical portion at its lower end and a shank intermediate the hook and enlarged conical portion, the intermediate portion being cylindrical and the enlarged conical portion being coaxial with and disposed entirely within the intermediate portion, the lower portion having a thickness in any lateral direction less than the diameter of the intermediate portion, the shank of the upper portion being inclined from the common axis of the enlarged conical portion and the intermediate portion and joining the enlarged conical portion at an obtuse angle, and a sleeve integral with the intermediate portion and of less diameter than the intermediate portion, the sleeve being inclined with the shank from the axis of the intermediate portion and enclosing a portion of the shank.

Plating Rack

U. S. Patent 2,841,549. *July* 1, 1958. *G. B. Hogaboom, Jr.*

A hanger for suspending a multiplicity of articles in an electroplating tank, said hanger comprising a linear body provided by a plurality of contiguous electrically conductive wire strands helically twisted together at intervals along the length of the body to form spaced apart interlocked sections, with selected strands, parted intermediate the interlocked sections to provide free end portions extending from the ends of said sections, said free end portions being bent into upwardly open article receptive hook members projecting laterally from the linear body, and an end portion of said linear body terminating in an inverted hanger hook formation to suspend said body from a cathode rod of an electroplating tank.

Portable Blast Cleaning Machine

U. S. Patent 2,840,955. *July* 1, 1958. *H. Hastrup and R. C. Hastrup.*

A portable abrasive blast cleaning machine to be carried and operated by a single operator, including an abrasive container, a blast head having a surface contactor boot adapted to contact an area of surface to be blast cleaned, an inner and an outer casing spaced apart to form an inner channel for the passage of abrasive toward said

surface and an outer channel for the passage of spent abrasive and debris from said surface.

Paint Spray Booth

U. S. Patent 2,841,073. *July* 1, 1958. *S. M. Forshee.*

A paint spray booth having a back, a top, side walls, and a front wall with an opening therein, an exhaust for said booth, and a backdrop curtain consisting of a continuous length of normally dry, highly absorbent fabric material, spaced from the back and sides of said booth, said curtain having a tensile strength sufficient to support itself, and having an exposed area dimension greater than the opening in said front wall, feed means for said material, and a removable receptacle for collecting previously exposed portions of said material.

Chromium Bath

U. S. Patent 2,841,540. *July* 1, 1958. *R. C. Smith, assignor to Diamond Alkali Co.*

The reaction product obtained by chemically reacting a chromium compound, an organic reducing agent and fluosilicic acid in amounts sufficient to yield a material containing about 23 to 28% chromium, 2.5 to 7.75% silicon and 24-36% fluorine.

In the process of electrodepositing chromium from an aqueous electrolyte containing chromium ions, and ions of an inorganic acid, the improvement which includes incorporating into said electrolyte an amount of the product defined above such that the fluorine content of said electrolyte is from about 0.5 to 7.0 grams per liter.

Chromium Bath

U. S. Patent 2,841,541. *July* 1, 1958. *R. C. Smith, assignor to Diamond Alkali Co.*

A composition of matter comprising the reaction product obtained by chemically reacting a trivalent chromium compound, silicon dioxide and a fluorine-containing compound, the proportions of these elements in the reaction product being about 27% chromium, about 26% fluorine and about 4% to 7% silicon.

Bright Copper Bath

U. S. Patent 2,841,542. *July* 1, 1958. *J. W. Manquen, assignor to The Udylite Research Corp.*

A plating bath comprising an alkaline copper cyanide bath containing in solution tellurium in an amount in the range of about 0.0002 to about 0.006 gram/liter.

Stripping Tin Deposits

U. S. Patent 2,842,435. *July* 8, 1958. *M. G. Milo, assignor to Western Electric Co., Inc.*

The process of stripping a surface coating consisting principally of tin from an article made of a metal of the group consisting of iron, steel and alloys of iron and steel, which comprises immersing such a coated article in an acid tin-stripping bath containing antimony trioxide until the coating has been stripped from the article whereby an antimony containing smut capable of penetration by copper ions forms on the article, treating the article with a solution of a copper salt whereby copper is precipitated from the solution on the smut so as to form a copper film on the surface of the article under the smut by copper ion penetration therethrough, converting the precipitated copper into a copper sulphide, and treating the article in an alkali cyanide bath to dissolve the copper in the copper sulphide, whereby the surface of the article is caused to be clean and substantially smut-free.

Basket Plating Apparatus

U. S. Patent 2,841,547. *July* 1, 1958. *R. W. Kotz, A. R. Dammkoehler and R. E. Belke, assignors to Belke Mfg. Co.*

An electroplating apparatus comprising a tank for electrolyte, a bus bar having electrical connections to carry current to anodes, said bus bar extending across the top of the tank, near one side wall of the tank, a plurality of anodes depending from said anode bus bar, each anode comprising a depending plate having a hook at its upper end mounted on the bus bar, and each anode having a horizontally extending plate carried by the anode to extend over the work pieces to assure uniform current distribution through the electrolyte to them, a cathode bus bar carried by the top of said tank and supported at its ends by an electric vibrator carried by the tank by means of resilient cushions to permit free vibration of the latter bus bar, a work supporting tray comprising a pair of vertically extending bars having hooks at their upper ends mounted on said vibrating bus bar and having means for securing the hooks to the latter bus bar to prevent relative motion, the work supporting tray comprising a rectangular member, the end walls of which are secured to said vertical bars to support the tray beneath the horizontal plates of the anodes, said tray having a mesh bottom for free access of electrolyte through the bottom to the work pieces carried thereby, the said horizontal plates being provided with a multiplicity of apertures for discharging upwardly bubbles of gas formed on the lower side of said horizontal plates during the electroplating operation, a source of energization of alternating current for said electric vibrator, including an electric circuit, said electric circuit also including an electric timing device adapted to repeatedly turn on the electric vibrator for a sufficiently short period of time to change the positions of the pieces and adapted to repeatedly turn off the electric vibrator over a longer and major period of time during which most effective electroplating takes place.

Paint Baking Oven

U. S. Patent 2,841,684. *July* 1, 1958. *W. J. Miskella.*

Apparatus for use in painting automotive vehicles of different size, comprising, in combination, a paint booth defining a longitudinal vehicle parking space therein, generally straight horizontal track means supported in said booth in an overhead position extending longidutinally over said vehicle parking space, a movable support carriage mounted on said track means for translation therealong and frame means supported on said carriage for translation by the latter.

Spray Gun for Pipe Interiors

U. S. Patent 2,842,095. *July* 8, 1958. *R. Leibner.*

A spray gun for lining the interior of small diameter pipes.

Primers for Vinyl Resin Coating

U. S. Patent 2,842,459. *July* 8, 1958. *F. Gollub, M. S. Wool and W. D. Berberich, assignors to Dennis Chemical Co.*

The method of bonding a vinyl resin coating to a surface which comprises applying a primer to said surface, said primer comprising a mixture of a methyl methacrylate polymer and an unesterified epoxy resin dissolved in an organic solvent, the ratio of said methacrylate polymer to said epoxy

resin being between approximately 15:85 and 99:1, volatilizing said solvent, applying a vinyl resin dispersion to the primed surface, and thereafter heating the dispersion.

Spray Gun Attachment

U. S. Patent 2,842,093. *July* 8, 1958. *K. V. O'Neill.*

A spray gun attachment adapted to be removably attached to a spray gun for spraying a confined surface area of a wall.

Spray Gun Attachment

U. S. Patent 2,842,094. *July* 8, 1958. *K. V. O'Neill.*

A spray gun attachment adapted to be removably attached to a spray gun for spraying a first surface area adjacent the straight edge of a second surface area.

Electrostatic Coating

U. S. Patent 2,842,460. *July* 8, 1958. *J. W. Juvinall, assignor to Ransburg Electro-Coating Corp.*

A method for electrostatically coating a pair of spaced portion of an article wherein each of said portions comprises adjacent divergent surfaces, comprising: providing from an atomizing head a spray of coating material in a pattern which is an annular band; providing an electrostatic field from said head to said spaced postions being coated; and rotating said article during such coating with the center of rotation being substantially midway between said spaced portions and substantially coinciding with the center of said annular band for a substantial period of time so that said spaced portions move in opposite sides of said annular band.

Immersion Lead Bath

U. S. Patent 2,842,461. *July* 8, 1958. *H. A. Wagner, P. Golar and J. R. Kusa, assignors to The E. F. Hauserman Co.*

The method of forming a substantial sound adherent protective lead coating on ferrous articles which comprises subjecting such article to the action of a water solution of lead formate and the at least slightly water soluble condensation product of ethylene oxide and an organic compound, the solution having a pH of from 2.5 to 5.0 and a lead ion concentration of from 1 to 80 grams per liter, for a period of time sufficient to deposit a continuous corrosion-resistant lead coating on such article by chemical displacement.

Dull Nickel Bath

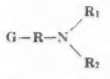
U. S. Patent 2,842,487. *July* 8, 1958. *D. S. Carr, assignor to Bart Laboratories Co., Inc.*

An aqueous, acid, electroplating bath which comprises in the aqueous meduim a nickel ion yielding material together with a reagent selected from the group which consists of ortho-formylbenzenesulfonic acid having not more than two sulfonate groups in the benzene ring and the salts of ortho-formylbenzenesulfonic acid added in an amount less than 1% by weight of the solids present in the electrolyte and sufficient to obtain upon electrolyzing of the bath at a temperature of about 130°F. and at current densities extending simultaneously over a fourfold range of the order of 35 to 140 amperes per square foot a dull nickel deposit with residual compressive stress and a hardness ranging from 440-710 Vickers as measured with a 1 kilogram load with a surface having a dull, satiny finish and a roughness RMS of materially more than two microinches.

Bright Copper Bath

U. S. Patent 2,842,488. *July* 8, 1958. *W. Strauss, A. Kirstahler and W. D. Willmund, assignors to Dehydag, Deutsche Hydriewerke G. m. b. H.*

In a process of producing bright copper electrodeposits from acidic copper electroplating baths comprising hard water, technical grade copper salts and a sulfonic acid brightening agent, the steps which comprise adding to said acidic copper electroplating baths from 0.01 to 20 gm./liter of a compound, free from carboxyl groups having the structural formula



wherein R is selected from the group consisting of lower alkylene, mono hydroxy lower alkylene and phenyl, G is selected from the group consisting of halogen, cyano, thiocyano and nitro, and R_1 and R_2 are selected from the group consisting of lower alkyl, monohydroxy lower alkyl, phenyl, cyclohexyl and heterocyclic radicals which include the nitrogen atom selected from the group consisting of morpholino and piperidino, the radical G and the nitrogen atom being attached to carbon atoms of radical R, their salts and their quaternary ammonium compounds formed with epichlorohydrin, and electrodepositing copper from said baths, whereby the impurities contained in said water and technical grade copper salts are prevented from interfering with the brightening action of the sulfonic acid brightening agent.

Corrosion Prevention of Aluminum

U. S. Patent 2,843,513. *July* 15, 1958. *R. Stricklen, assignor to Allied Research Products, Inc.*

An aqueous acid bath for coating aluminum and alloys thereof in which aluminum is the predominant ingredient, of the type wherein the essential coating-production ingredients are hexavalent chromium and a soluble fluorine-bearing compound in coating-producing proportions; containing, as an addition agent, a quantity of boron (calculated as boric acid) in excess of the amount required for reaction with all of the fluorine present.

Spray Gun

U. S. Patent 2,843,425. *July* 15, 1958. *J. A. Paasche, assignor to Cline Electric Co.*

A spraying device comprising a nozzle member, means for supplying material to be sprayed to said nozzle, a valve for controlling the flow of said spraying material, a body member connected to said nozzle member means disposed within said body member and operable by gas under pressure for actuating said valve, and a valve body disposed adjacent and detachably connected to one of said members.

ABSTRACTS

Hull Cell Investigation of Rhodium Plating Conditions

By S. Dorner and L. Froels: *Metallwarenind. und Galvanotechnik*, **49**, No. 7, 299.

The authors investigated the influence of various additions in the rhodium bath (impurities), using the Hull cell. A normal 2.5 g/l rhodium bath was employed; platinum sheet was used as the anode and polished copper sheet, plated for 4.5 minutes in a bright nickel bath, as the cathode.

Rhodium plating was conducted for 2½ minutes for all the tests. The tests showed the very good throwing power of the bath. Baths with 0.135, 0.270, and 0.515 grams iron per liter showed the same bright deposit as the non-treated bath. This applied to ferrous and ferric iron. Also, an addition of 0.6 g/l potassium ferrocyanide did not affect the deposit.

Additions to the bath of 0.045, 0.180, and 1.67 g/l nickel likewise showed no noteworthy change in the appearance of the deposit. It was found that additions of copper acted very strongly on the rhodium deposit. At the lower current densities, it appeared that only copper was plated out. The effect of copper becomes noticeable with less than 0.1 g/l; the deposits become streaky.

Similar results were obtained with the addition of silver to the bath. The influence of the silver became noticeable with quite small amounts; i.e. from about 10 mg/l. A non-adherent, black deposit, was obtained at higher current densities. When the silver was removed from the bath, good deposits were again obtained.

The harmful effects found with silver and gold salts in the rhodium bath serve to explain the often poor results reported with rhodium plating in the jewelry business. Very often, the silver and gold baths are placed in the immediate vicinity of the rhodium baths and, with careless working, there exists the danger that the rhodium bath will become contaminated with the solutions from these other baths.

It was found that the presence of tin affected rhodium deposition quite considerably; the affect of zinc was less and streaks were obtained only at higher concentrations such as 0.9 g/l. Deposits from a bath with 0.03 g/l zinc were good. No visible results were obtained with additions of nitric acid (8 cc/l), hydrochloric acid (12 cc/l), and ammonium persulfate (5 g/l).

The test results confirmed the previous work of Fischer and Leonhard, that the current density has a great influence on the action of foreign metals in the rhodium bath. Thus, with copper present, normal deposits are obtained in the higher current density ranges. However, in the lower current density range, practically pure copper is deposited. The reverse effect is obtained with tin. At the higher current densities, dark, unpleasant-looking deposits are obtained, while, at the lower current densities, a bright deposit is always obtained.

Electron Microscopic Examination of Plated Gold Surfaces

By K. Schulze: *Metallwarenind. und Galvanotechnik*, **49,** No. 9, 381.

Numerous useful conclusions can be drawn from a precise study of polished surfaces by means of the electron microscope. Examination of metal surfaces which are apparently highly polished shows that, in actual fact, they are very far from plane and smooth. Fine, flat scratches or pits can easily be seen; their width is below the wave length of visible light. However, if these scratches were located in a regular manner, close to one another, then an interference lattice would be provided; because of the extremely small lattice distance, this would still appear as a plane surface, under the optical microscope.

Apart from application to basis metals, gold is often applied on gold metal; this is to give another color tone or for masking purposes. The work must possess the required polish before the application of the gold plate. With a light gold plate, the surface characteristics appear unchanged to the naked eye. Under the electron microscope there will be seen a clear change of the surface structure. It will be seen that pits or groups of pits have been formed which, when they become larger, appear as a haze to the eye.

Very fine surfaces are obtained with a cold gold plating bath, from which bright, heavy gold deposits can be produced. Electron microscopic examination of such a deposit (brass base) showed that the pits were much smaller; the surface was mirror bright to the eye. If this surface is given a light polish, it is found that the coarser pores present have been reduced but that scratching has appeared.

Very striking results were found with the electron microscopic examination of a process for surface polishing termed "Electro-rub polishing." With this process, the part to be polished is held in a mobile manner as the anode and is moved backwards and forwards over a felt cloth which is held firmly stretched over a plane cathode (opposing electrode). The few scratches and fissures which can be ascribed to transporting and handling showed up prominently with the electron microscope. The smooth surface areas in between showed that, obviously, a much refined surface texture was obtained, as compared with normal wheel polishing.

The effects obtained with various polishing processes and compositions could very easily be followed with the electron microscope. A surface, polished on the wheel with a coarse polishing compound showed a diffuse, sharp brilliance, not the soft effect given by a more perfect surface. The numerous fissures form small surface areas, which reflect the light in all directions. A barrel polished surface showed good results on electron microscope examination. The surface roughnesses were found to be very small and the test part showed a high, uniform brilliance.

Hard Chromium Plating in Locomotive Construction Practice

By W. Schmitt, *Metalloberflaeche*, **11**, No. 11, 370.

It has been found that the wear-resistant, hard chromium plate, increases the running loading characteristics of the moving parts very considerably and is more economical accordingly, in spite of somewhat high finishing costs, as compared with normal practice. The pretreatment of the material before chromium plating is important to obtain satisfactory, trouble-free results. The steel used for running parts such as axles, journals, piston rods, etc., has a carbon content of below 0.35%, and is not highly alloyed. It offers no special difficulties, accordingly, as regards composition. Care must be given that the surface preparation of the steel is undertaken with the greatest caution. This is because the hard chromium plate will not adhere if the steel surface has been locally overheated for a short time, because of inattention during grinding, either because the cooling was insufficient or else the grinding wheel was presented at too great a pressure. Even though these areas are ground down again and the burning can no longer be seen, the chromium coating will not adhere. Particular care must be taken about this, in the case of parts obtained from outside sources.

The treatment of parts which have come in from previous use on the railway also requires special consideration. For example, if an axle shank has run hot in use, then an adherent chromium coating can no longer be ap-

plied because the basis material has been changed by hot-running. After some weeks, blisters form under the chromium coating, it peels away and, after stripping, the change in the basis metal can be seen, although not previously discernable when ground down.

Hardness tests are conducted before plating, to ascertain the suitability of the material. Highly prehardened steels are quite unsuitable for plating because, at some places, superhardening and stresses will be present. Because of the unavoidable hydrogen adsorption during plating, the stress limit will be exceeded at these places. The basis material and chromium coating become cracked and the chromium peels away. The higher the steel is hardened, the greater will be the danger that the surface becomes brittle and cracked by the hydrogen adsorption during plating. A hardness of about 710 Vickers is designated as the extreme limit. Hardening defects reduce the adhesion of the chromium coating and can often be seen only after plating.

Influence of Steel Quality on Thickness of Coating in Hot Galvanizing

By R. Gloor, W. Gerber and H. Oertli: Paper read at the 5th International Zinc Galvanizing Congress, Holland.

To provide an effective underwater protection, zinc coatings should be thicker than are obtained in normal operation. It is known that these thicker zinc coatings can be obtained by using longer dip times in the galvanizing bath. By simultaneously testing 5 different steels with varying silicon contents (0.05 —0.73%) it was established that a zinc coating thickness of 0.3 mm. can be obtained with a steel with 0.38% Si (0.17% carbon, 0.30% manganese, 0.013% phosphorus and 0.016% sulfur) with a dip time of 8 minutes and a zinc bath temperature of 450°C. This type steel is now used by the Berne power works in hot galvanizing for special underwater constructional applications.

Lead Additions in Hot-Dip Galvanizing

By E. C. Mantle: Paper read at the 5th International Hot-Dip Zinc Galvanizing Congress, Holland.

Work conducted on the effect of lead additions in the hot-dip zinc galvanizing bath, has served to confirm the results obtained by other investigators. It was found that the presence of lead facilitated the formation of smooth zinc coatings and, in addition, no undesirable influence was found with the presence of this metal. Further work on the influence of additions to the galvanizing bath has shown that the corrosion resistance of the hot-dip zinc coating is better with a low lead content. The action of aluminum addition to the zinc bath, in relation to the Al content and the bath temperature, was also discussed.

Non-Destructive Testing of of Zinc Coatings

By W. Peppler: Paper read at the 5th International Zinc Galvanizing Congress, Holland.

The characteristics of a zinc coating on steel are determined by the thickness and the structure of the coating. As the zinc coating thickness has the greater practical significance, the various possibilities for the measurement of this, were discussed in full detail. By means of electrochemical solution of the zinc coating, the structure of the metal can be ascertained simultaneously, as the potentials of the different phases, to some extent, differ from each other considerably.

Particular attention was given to the non-destructive methods of testing, comprising the magnetic test processes. The tests which operate in a purely magnetic manner were described, such as the equipment operating on magnetic-inductive and electro-magnetic principles. These various thickness testers were described and their behaviour followed with the measurement of the thickness of homogeneous, non-magnetic coatings.

With the extensive investigations conducted on test parts of various types of steel and varying zinc coatings, it was shown that the magnetic measurement is sufficiently accurate for practical purposes. Numerous examples were given showing the good agreement of the measurements of zinc coating thicknesses obtained by the magnetic, microscopic, and electrochemical test procedures.

With the beta-ray measuring apparatus, it is possible to determine the thickness of zinc coatings, with an accuracy of ±5%.

Anodic Behaviour of Various Types of Nickel in Plating Baths

By E. Raub and A. Disam: *Metalloberflaeche*, **12**, No. 7, 193.

The anodic behaviour of various types of nickel anodes were investigated by the authors. Two pure rolled nickel anodes, which differed little as regards their composition, showed the maximum polarization. A fine-grained electrolytic nickel anode with a very low content of foreign metals showed the same low anode polarization as a depolarized anode with a nickel oxide content of 0.40%. The polarization of the electrolytic nickel anode was even less than that of the depolarized anode. An anode with carbon and silicon addition dissolved with a polarization which was between that of the pure rolled nickel anodes and that of the depolarized anodes. With all the anode types, polarization in a pure chloride bath was always the lowest. The highest anodic polarization was observed in a bright nickel bath of the usual commercial composition.

Certain differences were observed during anode efficiency measurements. Under the test conditions, all the anodes, however, showed approximately 100% current efficiency.

The sliming characteristics were very variable with the individual anodes. A particularly strong slime formation was shown by the depolarized, rolled nickel anodes. The slime separation with these anodes must be associated with the eutectical arrangement of the nickel crystallites. The lowest slime formation was observed with the electrolytic nickel anodes. The two pure rolled nickel anodes tested behaved in a similar manner as regards the slime formation. With the anodes alloyed with the carbon and silicon, no bath slime was observed with perfect filming of the anodes.

With the pure rolled nickel anodes, the anodic attack under corresponding working conditions, led to pitting. The sludge formed was relatively coarse-grained and metallic. The anodes containing 0.02% carbon showed the presence of a film which acted in a favorable manner to the slime formation under certain working conditions.

With the electrolytic nickel anodes, the attack was always uniform. The etching-out of a nodular structure was observed, as is normally shown by

electrolytic nickel anodes. The small amounts of bath slime which occurred with these anodes were very fine-grained. The varying behaviour of electrolytic nickel anodes in practice was shown in the tests.

The depolarized anodes were always attacked uniformly under the extensive anode slime. Depending on the operating conditions, the surface under the slime had a gray appearance or was metallic bright. The slime was relatively fine-grained and had a metallic character.

The anodes alloyed with carbon and silicon formed, so far as any slime was formed in the bath, a very fine-grained, non-metallic-looking black bath slime. The attack of the anodes was always uniform with the presence of a coherent film. With imperfect filming of the anode, on the other hand, a pitting attack was seen.

Influence of Steel Structure on Hot Galvanizing

By J. I. Sebisty and I. O. Edwards: Paper read at the 5th International Zinc Galvanizing Congress, Holland.

In this paper, the authors dealt with the influence of surface carbides, varying steel attack and pore-formation during hot galvanizing. The influence of aluminum, lead, and iron on the structure of the zinc coatings was also considered.

It was stated that, in all cases in which greater carbide separations were found on the steel surface, there were neither gamma nor delta layers in the alloy layer lying over the carbide. In hot galvanizing baths saturated with iron, without aluminum addition or with 0.15 to 0.2% Al, almost no reaction of the carbides was established. With a medium Al content (0.1%) in the bath, with bath temperatures above 450°C. and in baths with iron, the carbides reacted vigorously with the zinc. The differences in the hot-dip coatings with almost two identical steel sheets were ascribed to a varying degree of cold-rolling reduction and to the take-up of roll grease into the surface of the sheet, which reacted more strongly in the bath. Pore testing at the surface of material processed by the wet galvanized method, showed that the pores were only of slight depth, associated with small particles of the ∂ —phase.

It was found that the dip time and the Al content of the zinc galvanizing bath had the greatest influence on the zinc coating, the iron content in the coating, and the thickness of the iron-zinc alloying layer. The lead content of the bath influenced the surface roughness of the coating, the brightness, and the flower formation, but not the adhesion and the ductility of the coating.

Electroless Nickel — Maintenance of pH.

By L. Bosdorf and K. Mueller: *Metalloberflaeche*, **12**, No. 5, 150.

The pH value of the bath is of decisive importance in nickel deposition by chemical reduction, for the rate of deposition and, accordingly, of the coating-thickness growth. The oxidation of the hypophosphite to phosphite according to the equation:

$$H_2PO_2^- + H_2O \rightarrow H_2PO_3^- + 2e + 2H^+$$

provides not only the electrons, e, required for the reduction of the nickel but, simultaneously, hydrogen ions, H^+. Actually, the greater part of these hydrogen ions are likewise reduced, as can be noted from the simultaneous generation of hydrogen gas during the nickel deposition. However, part of the hydrogen ions remain in solution. This leads to the known drop in pH during deposition from an electroless nickel bath.

Nickel deposition from the bath is greater at higher pH values; a pH value of 6 should not be exceeded. With too low a pH, deposition is decreased, which can be ascribed to resolution of the deposited nickel. Considering all these factors, a bath pH of 4.5 to 5 has been found best; the best buffering action of organic acids is also obtained in this range. The authors investigated the influence of sodium glycolate for this purpose and ascertained the best concentration. A bath of the following composition was employed for the tests: 30 g/l nickel chloride; 2.5 g/l cobalt acetate; 10 g/l sodium hypophosphite. During the tests, 5 g/l sodium hypophosphite were added to the bath every 30 minutes. The addition of cobalt acetate was made because previous tests had shown that bright deposits are obtained with this. The bath temperature was held constant at 97° - 98°C. For control, the pH value of the bath was determined at intervals of 30 minutes.

The tests showed that, without glycolate addition, the pH fell from the initial value of 4.5 to 3.08 within 120 minutes. With increasing concentration of glycolate, the pH drop was smaller and, at 60 g/l, the pH fell only to 4.31. With regard to the coating thickness increase with time, it was found that the curve obtained did not steadily rise, as would be expected, but that it had a maxmium of 34.5 microns with an addition of 30 g/l of glycolate. Without glycolate addition, only 11.3 microns thickness was obtained in the same time and, with 60 g/l, a thickness of 29.0 microns.

It follows that the pH is not alone responsible for the coating rate. The latter is dominated more by the catalytic effects, which the buffering increases. Thus, although with 30 g/l of glycolate, the pH falls to 3.89, the nickel deposition is greater than with a smaller pH drop. The concentration of glycolate, accordingly, should be so chosen that the pH drop permitted by the buffering and the catalytic action of the buffering, lead to a maximum coating thickness increase. This is the case with 30 g/l of glycolate. Comparative tests made with these buffering salts and the corresponding acids, showed that greater coating thicknesses were obtained with the salts.

Mat Dip Bath for Brass and Tombac Alloy

Metalloberflaeche (Germany), **12**, No. 5, 152.

The extent to which the desired characteristics are obtained by a mat-dip bath, depends on the composition of the alloy and pretreatment of the parts. Chromate baths are generally used for mat dips. These are formulated with alkali chromate or dichromate and sulfuric acid. An addition of sodium chloride or hydrochloric acid is usually made as well. A typical bath of this type is:

Potassium chromate	200 g.
Sulfuric acid	60 g.
Sodium chloride	1 g.
Water	1 l.

Potassium dichromate also is often used for these baths in which case 100 - 150 g. of potassium dichromate and 50 - 100 g. sulfuric acid are used per liter of water.

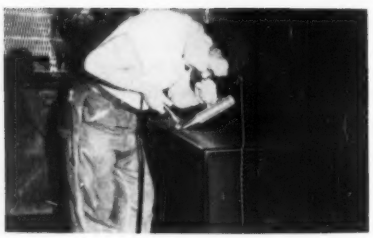
The chromate baths are used cold and require a fairly long dip time. If the parts are to be plated after mat pickling then, after a thorough prerinsing, a dip should be given in dilute sulfuric acid, so as to remove the surface films from the chromate bath.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Kit for Repairing PVC Linings and Coatings

Perma-Line Rubber Products Corp., Dept. MF, 1753 N. Winnebago Ave., Chicago 47, Ill.



All the tools and accessories required to make any type of repairs on polyvinyl chloride linings of acid tanks are now available in kit form. The tools can also be used to make repairs on plastisol coated plating racks and plastic duct work. These are professional tools, identical in every respect to those the manufacturer uses in putting on the tank linings in the first place.

The kit consists of a spark tester, a heat resistant stainless steel Perma-gun, dual seamer, stitcher, utility knife, and adequate supplies of cement, patching material and seaming material.

Perma-Line is so confident that you will want these tools after you have seen them that it is offering the complete set to you on an unconditional money back guarantee basis. Buy them, if after two weeks you wish to return them — send them back. As simple as that. All for $159.00 postpaid.

Aluminum Etch Cleaner

Enthone Inc., Dept. MF, 442 Elm St., New Haven, Conn.

Etchalume 14 is a strongly alkaline material which was originally designed to etch aluminum rapidly and uniformly without the formation of aluminum hydroxide scale or cake on the work, tanks or heating coils. A newly developed formulation is twice as effective in this respect and, in addition, has much longer life. These improvements have been made at no increase in price.

The new, improved material is a powder which is added to water and can be operated over a wide range of concentrations and temperatures, depending upon the degree of etching desired. It produces a fine, uniform etch and leaves the surface of the aluminum clean and free from any residual, slimy film of aluminum hydroxide. The product contains complexing agents which cause the aluminum dissolved in the bath to precipitate as a loose, flocculent powder rather than as a hard, tenacious scale as is the case with straight caustic soda solutions.

The material is ideal for cleaning and etching of aluminum prior to plating, anodizing, bright dipping, welding, phosphating and chromate conversion coatings. It is very effective for selective reduction in size of sheet or wire by etching, where the thickness must be reduced uniformly. Its rapid etching properties are also used for chemical deburring and for etching of nameplates.

Gold Electroplating Process

Lea-Ronal Inc., Dept. MF, 139-20 109th Ave., Jamaica 35, N. Y.

The Auro Glo gold plating process is characterized by extreme simplicity and stability of the plating bath. Deposits show hardness and wear resistance that are from 5 to 10 times as hard as gold deposits from a conventional cyanide bath and 2 to 3 times as hard as deposits secured from bright cyanide gold solution, it is claimed. Because of this hardness users have found it possible to substitute thinner deposits without impairing the performance characteristics or quality of the end product. Industrial operations have produced dense, compact, lustrous ductile deposits as heavy as 0.008″ that show excellent adhesion to basic metal.

The manufacturer states that deposits from the new bath have superior solderability and weldability and do not bleed out, as do conventional cyanide bright gold baths, and do not require extreme leaching operation.

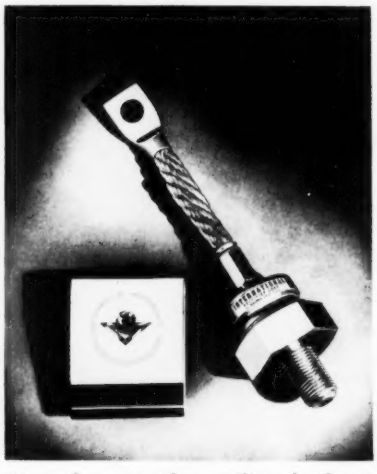
For the decorative industry this process offers in addition to hardness of deposit, the ability to secure numerous alloy colors ranging from rich yellow golds to the very desirable paler "Hamilton" shades so popular in the industry.

Silicon Rectifiers

International Rectifier Corp., Dept. MF, 1521 E. Grand Ave., El Segundo, Calif.

High current silicon power rectifiers providing d.c. forward currents up to 250 amperes with a maximum peak inverse voltage range from 50 to 500 volts, are designed for use at high temperatures and are capable of operation at a junction temperature of 190°C.

Engineered and manufactured to meet the most rigid military specifications, these rectifiers utilize the latest techniques in hermetic sealing to provide additional reliability in environmental extremes of temperature, vibration and shock. To further increase reliability and assure freedom from contamination, no soft solders or fluxes are used in sealing.



Sel-Rex®

Plating Progress

Sel-Rex®

Published by SEL-REX CORPORATION

FEBRUARY 1959 NUTLEY 10, NEW JERSEY No. 7

TIME-TESTED ACID GOLD PLATING PROCESS

Karatclad Wins Customers For Manufacturers Of Razors, Watchcases And Jewelry

Able to produce consistently uniform, high-fashion colors, the KARATCLAD Acid Gold Plating Process has been winning customers for over a year for some of the country's leading manufacturers of razors, watchcases, pens and costume jewelry. The process produces mirror-bright deposits, in any desired thickness, directly from the bath—*in the shade or color of your choice.*

According to a manufacturing jewelry spokesman, KARATCLAD gives the industry a freedom of design it has never known before, since a substantial layer of Gold is applied *after* the product has been manufactured. Delicate filigree, etched patterns, and high-fashion three-dimensional designs are now practical with KARATCLAD which deposits a uniform thickness of Gold on the entire piece—as the last step in the manufacturing process.

The KARATCLAD Acid Gold Plating Process is the only material which permits practical compliance with the new quality marking "Heavy Gold Electroplate," authorized by the Federal Trade Commission. The minimum 100 millionths thickness specified in the regulation, is produced in one continuous plating operation, with no scratch brushing, polishing or buffing.

KARATCLAD also offers many advantages to users of thinner Gold coatings. Such users can produce—*consistently* —the color of their choice, in non-tarnishing coatings in the FTC specified minimum thickness of seven millionths—without the extra cost and bother of lacquering.

For a copy of the new Federal Trade Commission rulings, technical data and standard color descriptions on KARATCLAD Acid Gold, ask for FTC-G.

FREE LITERATURE CORNER

Just Off The Press . . .

- ☐ **FTC-G • KARATCLAD Acid Gold Plating Process for Decorative Applications and Copy of New FTC Ruling Covering Gold Plating—4 pages.**
- ☐ **HDX • Sel-Rex Hot Air Dryer — technical data sheet.**
- ☐ **AG-2 • Autronex Acid Gold Plating Process for Industrial Applications—3 pages.**
- ☐ **SX-c • Silvrex Bright Silver Plating Process —Technical Paper, 13 pages.**
- ☐ **PA-1 • Sel-Rex Plastic "Armor" Sprays, Paints, Dips, Thick Air-Dry Coatings. New product development bulletin—4 pages.**

Still Available . . .

- ☐ **RX-2 • Rhodium Electroplating Processes — 24 pages, demonstrations and charts.**
- ☐ **PR-1 • New "Guide" to Plating Rectifiers—20 pages, illustrated.**
- ☐ **PC-1 • Printed Circuits Plating Developments —Technical Article—4 pages.**
- ☐ **BR-a • Gold Plating—Industrial and Decorative, 8 pages, illustrated.**
- ☐ **FD-b • Gold Plating in Electronics by Federal Telephone & Radio—4 pages, illustrated.**
- ☐ **PLT-1 • PLATANEX, Reliable, low stress Platinum Plating for high temperature uses.**

NOTE: For your convenience, when requesting the literature you want, simply refer to it by the prefixed code.

New Hot Air Dryer Speeds Transistor Production

The new Sel-Rex Hot Air Dryer pictured below, has speeded up production in the manufacture of expensive transistor products in the plant of a leading manufacturer of electrical products for industry. The delicate transistors are lowered into the dryer

in a wire basket, after a postplating hot water rinse, and are removed in less than two minutes ready for packing. In addition to speeding up the drying operation, the Sel-Rex Hot Air Dryer eliminates the possibility of damage to delicate components, inherent in centrifugal-type dryers used in similar applications.

Constructed of #20 gage sheet steel, interior galvanized, with the exterior finished in grey enamel, the hot air dryer is equipped with a thermostat permitting temperatures as high as 250 degrees Fahr. Two-inch glass wool insulation keeps the exterior cool to the touch during operation.

Catalog sheet #HDX gives details.

New Slide Chart Tells Precious Metals Plating Costs At A Glance

The cost of precious metals plating per unit area to specified thicknesses, may be seen at a glance with the new Sel-Rex Precious Metals Data Chart. By simply setting the device to the price paid per troy ounce or gram, you read instantly the cost of plating Gold, Platinum, Silver, Rhodium, and various proprietary precious metals plating formulations.

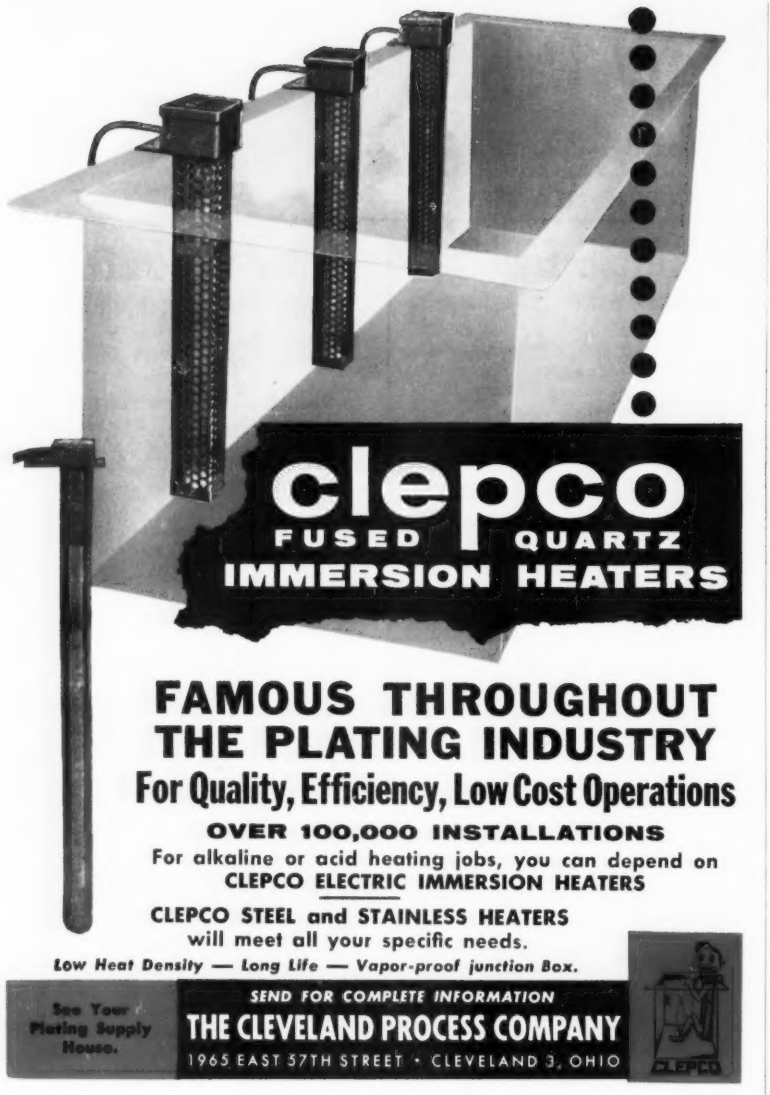
The copyrighted slide chart also tells at a glance: Cathode Efficiency Data; milligrams per square inch and grams

per square foot of particular precious metals for .0001" deposit; recommended current densities and actual plating time in minutes for nine different precious metals plating formulations; and corresponding thicknesses, in millionths of an inch, of one milligram per square inch, and one gram per square foot, of the various precious metals.

Users of precious metals plating will save countless hours of tedious calculating with the Sel-Rex Precious Metals Data Chart, as well as minimizing the possibility of expensive errors in cost-estimating.

Refer to it just once—and you'll save many times the purchase price.

One Dollar ($1.00) — cash, check or money order—shipped postpaid.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Zinc Chromate Paint Stripper

Patclin Chem. Co., Inc., Dept. MF, 11-23 St. Casimir Ave., Yonkers, N. Y.

No. 206 has been developed to strip "hard to remove" zinc chromate primer and Army and Navy spec. olive drab coatings from aluminum, zinc, magnesium and steel without attacking the basis metal or affecting underlying phosphate, chromate or anodize.

The product is used cold, full strength, in a mild steel tank and will remove zinc chromate primers, alkyds, styrenated alkyds, nitrocellulose, cellulose acetate and oil base coatings. It is especially effective on die castings and phosphated surfaces where the large surface area gives the coatings a strong adhesive bond and where the lifting type stripper is unable to do a clean job and necessitates hand brushing.

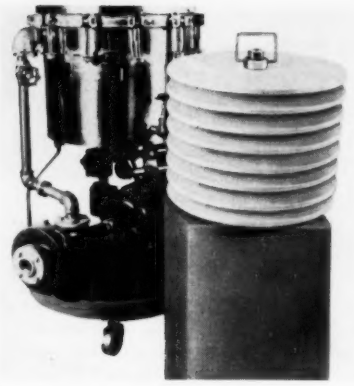
The new method is unique in that it dissolves the coating without causing it to become sticky, and solubilizes it so that the stripped piece can be rinsed clean with water, without leaving residues, and without necessitating hand scrubbing. It is shipped in 55 gallon non-returnable drums.

Wash-Off Filter Cartridge

Sparkler Mfg. Co., Dept. MF, Mundelein, Ill.

A new type of filter plate called the "Wash-Off" cartridge is now available for use in the manufacturer's standard horizontal plate filters.

These plates are assembled as a removable cartridge similar to the standard horizontal plate type but, when removed for cleaning, it is not necessary to disassemble each plate to remove the spent cake and filter paper to prepare for replacement. The complete plate cartridge can be cleaned as a unit and returned to the tank for use in a fraction of the time required to clean individual plates.



New filters can be supplied equipped with the new plate cartridge or the cartridge only can be furnished for existing horizontal plate filter tanks.

Flameproof Buffs

American Buff Co., Dept. MF, 2411 S. La Salle St., Chicago 16, Ill.

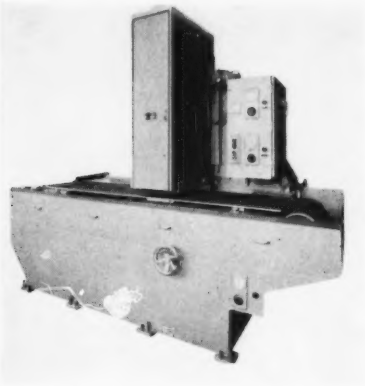
Designed to avoid the risk of disastrous fires often caused by finishing operations, a new safety treatment is announced by the above manufacturer for its entire line of cotton and sisal buffs.

This new Flameproof Treatment positively retards flame, it is claimed. Buffs cannot ignite even when directly exposed to fire. It is a positive guarantee against fire hazards ordinarily unavoidable in high-speed lathe operations where buffs constantly build up heat during long periods of contact with work. This treatment also contributes new savings in operation. Its inherent adhesive texture holds more buffing compound, speeding up cutting and coloring, reduces compound consumption, helps hold down production costs, it is stated.

Wide-Belt Flat Sheet Grinder

Engelberg, Inc., Dept. MF, 831 West Fayette St., Syracuse 4, N. Y.

Designed to offer a greatly increased range of work-piece capacities, this new series of conveyor-type models will belt-grind flat stock to extremely fine, micro-inch finishes, at continuous



through-feed rates of from 10 to 60 feet per minute. The single-head model shown, with 25 H.P. totally enclosed fan-cooled belt-drive motor, will accommodate sheet stock up to 22-inches wide, any length. Other wide-belt models are available in various belt widths, with single or multiple grinding heads. For heavy stock removal and precision sizing requirements, machines are furnished with higher H.P. abrasive belt drives. Standard workpiece height capacity is 6 inches.

Features of these wet-or-dry wide-belt flat sheet grinders include: pneumatic tensioning of abrasive and conveyor belts; automatic tracking of abrasive belt; a safety interlock mechanism which prevents operation in the event of insufficient air pressure of belt breakage; individual micrometer adjustment of grinding heads; and dynamically balanced contact and idler rolls mounted on precision anti-friction bearings.

Improved Trichlorethylene

Hooker Chemical Corp., Dept. MF, Niagara Falls, N. Y.

Rocket and missile parts manufacturers who use trichlorethylene both for flushing of components and also for vapor degreasing applications can now benefit by using a single Nialk grade for both purposes. An improved metal degreasing grade serves as efficiently as the former MD grade for metal degreasing and, in addition, meets the rigid requirements for flushing of rocket and missile components which had required another grade. This simplifies purchasing, inventory and materials handling, and eliminates the possibility of using the wrong grade for a given job. Cleaning costs are also reduced since stability of the solvent makes it possible to recover and re-use it repeatedly, the recovered solvent being just as stable as fresh trichlorethylene.

Flushing of rocket and missile components, a rapidly growing application, demands a solvent having a very low residue on evaporation and also non-impact sensitivity in the presence of liquid oxygen. The improved trichlorethylene has a residue on evaporation of 0.0005% maximum, one-tenth of the former residue maximum, and also meets all impact sensitivity requirements.

Slide Chart for Precious Metals Plating Costs

Sel-Rex Corp., Dept. MF, 75 River Road, Nutley 10, N. J.

The cost of precious metals plating per unit area to specified thicknesses, may be seen at a glance with the new Precious Metals Data Chart. By simply setting the device to the price paid per troy ounce or gram, one can read instantly the cost of plating gold, platinum, rhodium, silver and various proprietary precious metals formulations.

The copyrighted slide chart also tells at a glance: cathode efficiency data; milligrams per square inch and grams per square foot of particular precious metals for .0001" deposits; recommended current densities and actual plating time required for nine different precious metals plating formulations; and corresponding thicknesses, in millionths of an inch, of one milligram per square inch, and one gram per

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The experience gained in over 70 years of machinery building has provided us with a big bank of "Know How."
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The Rotary Automatic illustrated represents one of our many types and sizes of automatic finishing machines for either continuous rotation or indexing. The head and stand units shown are a part of a large "family" which range in type and size up to 20 HP.
SEND SAMPLES and we will show you how much you can speed up production and cut costs.
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BUCKINGHAM PRODUCTS
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REPRESENTATION IN MAJOR CITIES
WRITE for SAMPLE!
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STAINLESS STEEL BUFFING COMPOSITION
IT MUST BE GOOD
OVER 3,000,000 pounds sold since first introduced.
Outstanding for CUT and COLOR when used with all types Sisal Buffs... Also produces high color with cloth buffs.
The BUCKINGHAM PRODUCTS CO.
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square foot, of the various precious metals.

It is reported that users of precious metals plating can save many hours of tedious calculating with the device, as well as minimizing the possibility of expensive errors in cost-estimating.

The chart is available at the cost price of one dollar (post-paid).

Media Separator

Roto Finish Co., Dept. MF, Kalamazoo, Mich.

A new design principle for more effective screening and separation of barrel-finished parts and abrasive media has been built into a vibrating type separator machine. The unique feature of the separator is a vibrating unit which imparts high frequency, low amplitude vibrations to the screening mechanism. This permits faster, more efficient separation and screening of processed parts as well as rescreening of media sizes.

A larger bed, with a screening surface measuring 18 in. wide and 48 in. long, presents a greater work area than that of earlier types and does a more effective separation job with a wider range of parts and media sizes and shapes.

Another important flexibility feature is the separator's ready adaptability to handle all standard screen and mesh sizes. Powered by a 220/440 volt, 3-phase, 60-cycle AC motor with standard non-reversing push button controls, it comes equipped with three screens for most standard separating operations.

The unit is completely shock-mounted to dampen vibrations in the separator. This eliminates the need for holding bolts usually required to keep conventional type separators from "walking."

Booster for Caustic Soda

London Chem. Co., Inc., Dept. MF, 1535 N. 31st Ave., Melrose Park, Ill.

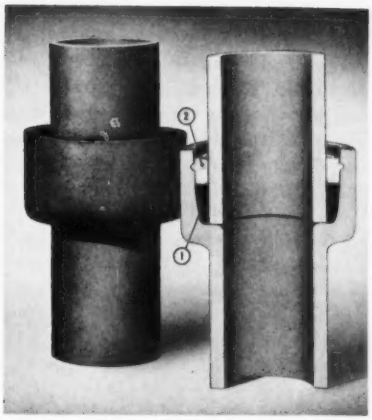
Outstanding savings in cost and space requirements are now possible with a new activator called Lonco Alka-Strip Booster. Using a ratio of 1 pint to 500 gallons of caustic solution, it replaces wetting, dispersing, settling, and softening agents.

With this material, caustic solutions are claimed to work faster, better, and last longer. Sludge is agglomerated and suspended instead of going into solution or settling on tank bottom, keeping solutions clean and active for much longer periods of time.

Bell and Spigot Joint

Maurice A. Knight Co., Dept. MF, Akron 9, Ohio.

Knight-Ware pipe and fittings, the quality chemical stoneware used wher-



ever corrosive liquids and gases must be handled, is now being shipped with a newly designed bell and spigot joint. This new joint provides a positive seal that cannot be broken by acids, solvents nor heat. Yet it is a very simple seal to make.

As shown in the cross-section photo, three rings of No. 2642 acid-proof rope (1) are caulked tightly between the bell and the spigot. Then, about ¾″ of lead wool (2) is caulked on top of the rope to hold it firmly in place. All the hubs on the pipe and fittings have been redesigned to accommodate these new sealing materials. This joint does not require melting pots, flame or heat, thus installations can be made in cold, unheated buildings without danger of thermal shock breakage.

Aluminum Etch

Kelite Corp., Dept. MF, 81 Industrial Road, Berkeley Heights, N. J.

Alsite imparts a decorative etch finish to aluminum and aluminum alloys by immersion, which hides die marks and some structural imperfections; gives a final decorative finish to aluminum articles; and provides a base for further finishing, such as lacquering, anodizing, chromating, or other proprietary aluminum finishes.

A powdered, dustless composition, the material is concentrated and readily soluble in cool or warm water. It exhibits controlled foaming to trap alkali spray; removes light, oily soils; and prevents formation of aluminum oxide scale on tank and heater parts. The etch rate is catalytically accelerated, exceeding that of caustic soda. Depth of etch is exceptionally uniform, thus making the product suitable for engineering applications, it is claimed. Economical to use because of its long bath life, the product has excellent storage stability and will not cake.

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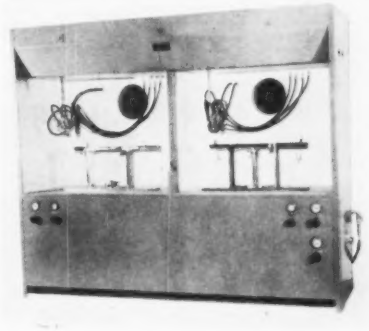
Available to volume etchant users is Alsite CX, a concentrated, dustless, powdered additive. When used with liquid or flake caustic soda, it provides an aluminum etchant identical to Alsite.

Automatic Paint Spray Machine

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A new double vertical fixture automatic spray machine for high production painting of low cost jobs enables one operator to double the production heretofore requiring two hand sprayers. The machine is designed for fast, perfect finishing of one, two or three surfaces of generally oval or rectangular shaped pieces of varying length, where fine mask definition and paint demarcation are imperative.

The operator unloads and loads one station while the machine is decorating in the other, thus eliminating any loss



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PLATING INDUSTRY

There's reason for Triangle Brand Copper Sulfate and Nickel Sulfate being close friends with the plating industry. Over the years they have proved their DEPENDABILITY.

Why? It's obvious — purity, uniformity, solubility and high conductivity of their solutions result in *quality plating.*

All-important "extras" found in the use of Triangle Brand Copper Sulfate and Nickel Sulfate yield long-life plating performance that *makes the difference.*

Insist on Triangle Brand Copper Sulfate and Nickel Sulfate for dependable plating baths.

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of operator time and making the equipment ideal for use with a fast conveyor. If desired, small areas can be painted in one station and large areas in the other, or parts may be sprayed a different color in each station. The machine, furthermore, can be operated so as to use one or both of the stations.

A new wrist-action device is provided so that the overhead traveling guns may be tilted in one or two directions, painting in both directions, but only when the part is in painting position. The length and speed of painting stroke is easily adjustable. The guns cover hard to reach corners and edges, spraying under the mask bridging and into all recessions in the part. Wasteful over-travel of the guns is greatly reduced. They can also be set so as to remain motionless. Standard gun mounting rods may also be employed. Ready access to the guns makes for ease of adjustment.

The square shaft vertical fixtures alternately lower and raise the part, placing it snugly in the mask for painting. The fixtures are adjustable so as to paint a wide range of different sized parts which heretofore required special individual fixtures.

The two plenum chambers each provide adequate space for disbursement of atomized material, and have separate exhausts for quickly removing overspray.

The machine is entirely air operated and housed in its own booth. Air filtering, cylinder and air valve lubrication, and water trap ejector are all automatic. The equipment comes ready for production upon tying in air lines and exhaust stack. The machine illustrated measures 96″ x 36″ x 79″ high.

Grinding Discs

Abrasive Products, Inc., Dept. MF, Pearl St., South Braintree 85, Mass.

Called "Spitfires," these new solvent and waterproof aluminum oxide discs feature fully reinforced edges and a special built-in shape control which eliminates limpness and disintegration due to excessive grit loss.

Other features of the new discs are their sharp, uniform cutting action to make full use of disc grinding surfaces and a cool running performance which prolongs disc life and productivity.

The discs are available in "Special," "Standard," and "Heavy Duty" models for a wide range of grinding and finishing applications. Their uses include light gauge metal sanding and polishing, light and heavy weld and braze removal, and high speed finishing. The discs are made in grit sizes 16 through 180. Diameters include 6″, 7″, 8″ and 9⅛″ with ½″ and ⅞″ arbor holes. Discs are shipped plain unless order is marked "Slotted."

Paint Heater

Binks Mfg. Co., Dept. MF, 3122 W. Carroll Ave., Chicago 12, Ill.

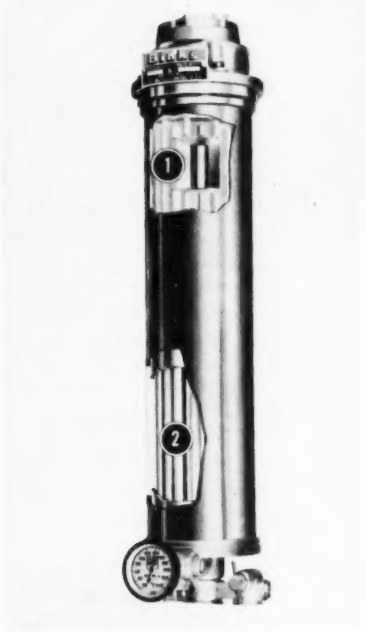
A new paint heater incorporates an entirely different design concept that provides safe heat with a direct type of heater element. The safe heat feature is made possible by designing the paint tract around the heater element. By having the heater element in the center of the paint tract, maximum heat transfer efficiency is obtained without the dangerous high temperatures that are found in ordinary electric heaters.

The paint tract consists of 22 long slots or passageways equally spaced around the outside diameter of a cylindrical aluminum block. The heater element is in the center of the block. Passageways are arranged so that all the paint entering the heater must pass through each of them before leaving the heater. Over all, the paint travels a distance of 27 linear feet, over more than 3⅓ square feet of heating area.

Since the heat is emitted radially from the center of the block outward, it must pass through the paint before it is dissipated, thus assuring the greatest possible efficiency. Heat transfer is accomplished with a surface block temperature only a few degrees higher than the desired paint temperature. Thus, clogging or baking due to high temperatures is eliminated. Should the need arise, however, for cleaning the paint tract, it is easily removed. Removal of the outside tube allows the entire tract to be withdrawn.

The new heater is available for either circulating or non-circulating paint systems, and for 115 or 230 volt operation. Either model features a 1500 watt heating element, each has a capacity of 30 ounces per minute delivery at a maximum temperature of 160°F.

Non-circulating types are recommended for a spraying opration that is not constant. For constant use the circulating type is recommended. This type is equipped with a recirculating pump, to avoid heat loss. Positive uniform viscosity is assured by a thermostat control, which is factory set at 160°F. Other settings are available. Approved by Underwriters Laboratories, the heater has undergone rigid performance testing under actual product finishing conditions for more than a year.

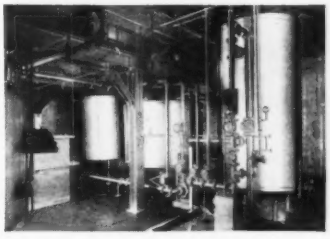


ionXchange

DO YOU WANT TO SAVE MONEY?

Here is how to solve some waste disposal problems -and reduce costs at the same time

IonXchangers of several types, and various units of allied equipment, as designed and manufactured by Illinois Water Treatment Company, offer a number of money-saving opportunities. *For example, consider the waste water from rinse tanks.* Contaminants can be removed and concentrated, and *pure* water returned to the rinse system. In some instances, chrome and other valuable metals can be recovered from the rinse water. *For another example, consider plating solutions* which, under many circumstances, become polluted and less efficient. The contaminating materials can be removed, recovered if valuable, and the bath maintained at high purity. Also, impurities found in water supplies, to spoil the appearance of plated or anodized parts, can be removed so that uniform quality of work is assured. Spent metal finishing solutions such as aluminum bright dip can be purified for re-use. Toxicity in otherwise-clean waste can be eliminated. All of these treatments will, in one way or another, contribute substantially to improved products, more efficient operations, and lowered costs. *Specific possibilities of applications of ionXchange in your plant can be determined by talking to your ILLCO-WAY representative.*



IonXchanger recovery unit for plating solutions

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CANADIAN DIST.: Pumps & Softeners, Ltd., London, Can.

ILLCO-WAY

Hot Spray Vinyl Coating

Gates Engineering Co., Dept. MF, Wilmington 99, Del.

A new hot spray vinyl that gives 5 mils of protection in a single spray coat is a high solids solution formulated for hot spray applications. The manufacturer states that the formulation and spray techniques allow deposit of a heavy quick-drying film, with little overspray and excellent edge build-up and resistance to sagging.

The product has a long shelf life, dries rapidly to a tack-free, low-gloss film of moderate flexibility. The coating can be applied with any standard hot spray apparatus which embraces circulatory system and spray gun. Unit coat thickness of 5 mils is obtained with one-half fan width on each stroke. Thus, the required thickness may be built up in fewer coats than with the cold spray method.

Solution Replenisher

Cincinnati Cleaning & Finishing Machinery Co., Dept. MF, 2026 Hageman St., Cincinnati 41, Ohio.

A solution tank replenisher automatically feeds dry chemicals into

ARMORHIDE® coating on IBM 305 RAMAC

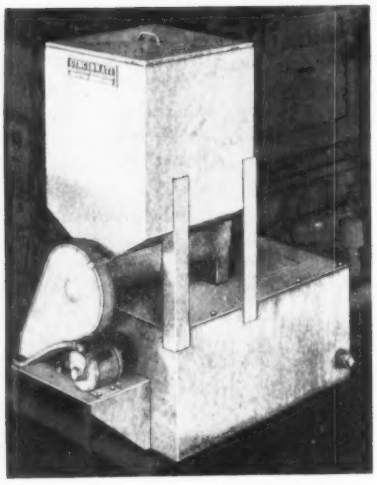
New metal coating looks like leather and is ten times more abrasive resistant.

Basically a textured plastic finish applied to metal and resembling leather, Armorhide is characterized by very high abrasion and chemical resistance. Similar to laminated Vinylite, Armorhide does not require expensive solvents and is sprayed on metal at a minimum of 60% solids at the gun.

Thus Armorhide is a new and entirely different kind of finish with physical and chemical properties unlike any other finish.

Write today for free booklet and sample panel.

JOHN L. ARMITAGE ARMORCOID & CO.
Synthetic Enamels, Paints, Varnishes, Lacquers
245 THOMAS STREET · · · NEWARK 5, NEW JERSEY

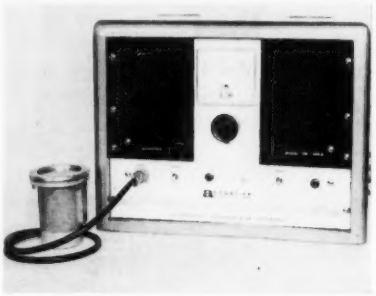


water, mixing the two as they are introduced to the main tank. Simple construction makes for fool-proof operation: when the controlled solution tank level drops, a float valve actuates a screw conveyor which accurately feeds dry chemicals from a hopper. At the same time, a solenoid valve furnishes fresh water at the rate required for proper solution strength. If the chemicals are readily soluble, mixing occurs without mechanical help; if not, a simple electrical tank agitator can be supplied. Solution strength is easily and accurately variable. Hopper size can provide automatic replenishing over any reasonable length of time, a work shift, a day, or a week. The replenisher can be remotely located if desired.

Ultrasonic Cleaner

Acoustica Associates, Inc., Dept. MF, 26 Windsor Ave., Mineola, N. Y.

The DR-500-AL is the modernized version of the manufacturer's best-selling standard DR-400-AL, which it

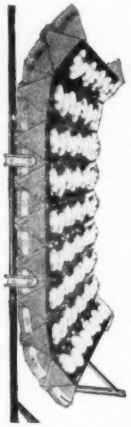


now replaces. The new ultrasonic cleaning system has increased the power from 400 to 500 watts. This higher power and increased transducer efficiency have actually doubled the cleaning effectiveness. The price is only $1375. Tank sizes range from ½ gallon to 2 gallons to meet varied cleaning needs. The generator is housed in an attractive new compact cabinet which is portable. Use of the latest components gives fool-proof, trouble-free, dependable operation.

An important new feature of the unit is its greater resistance to very high temperatures. The up-dated equipment does not use epoxy cement for attachments to the transducer diaphragm, using high-temperature brazing instead. Therefore, it can be used at extremely high temperatures, limited only by the brazing temperature.

Infra Red Ovens

Wil-Son Mfg. Co., Dept. MF, Clovers-port, Ky.



A new system of wiring has just been developed for the Patent-Flex infra-red ovens. This new construction consists of a roll-formed wiring raceway on each lamp row, in which the raceway cover easily "snap-locks" in place. The cover can be removed instantly, using a screw driver to snap release it.

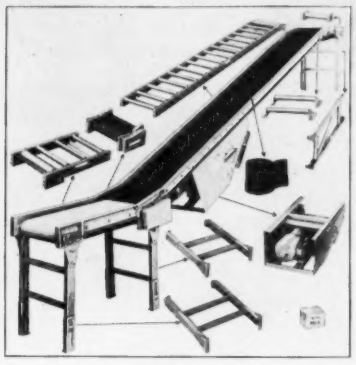
A new outlet box mounting plate is permanently attached to the wiring channel, and is provided with a bushed hole for bring-

ing the leads to the power supply. This new construction permits the simplest possible power connections.

The new wiring system, together with instant adjustability makes possible one standardized oven for any infra-red application.

Belt Conveyors

Alvey-Ferguson Co., Dept. MF, 3049 Disney St., Cincinnati 9, Ohio.



"E-Z-Bild," new, standardized, pre-engineered components which can be quickly and easily assembled to make custom belt conveyors for specific job requirements, make the cost-cutting efficiency of custom belt conveyors available to a larger number of companies and a wider range of operations.

Assembly of the new components requires no special training. Even unskilled personnel, using common mechanic's hand tools, can erect level, inclining or declining roller bed belt conveyors of any desired length and in belt widths of 10-, 14-, 18 or 22-inches. The large and complete line of components includes straight "intermediate" sections, top curves, feeder sections, drives, take-ups, belts, idlers, floor supports and ceiling hangers.

Side frames are designed so that bed rollers can be set either high or low. In the latter position, the belt conveyor's side frames protect the load by serving as guard rails. Reversible end and center drives can be supplied in a wide range of horsepower ratings. End drives can be mounted either under the conveyor or on one side.

Corrosion Resistant Finish for Aluminum

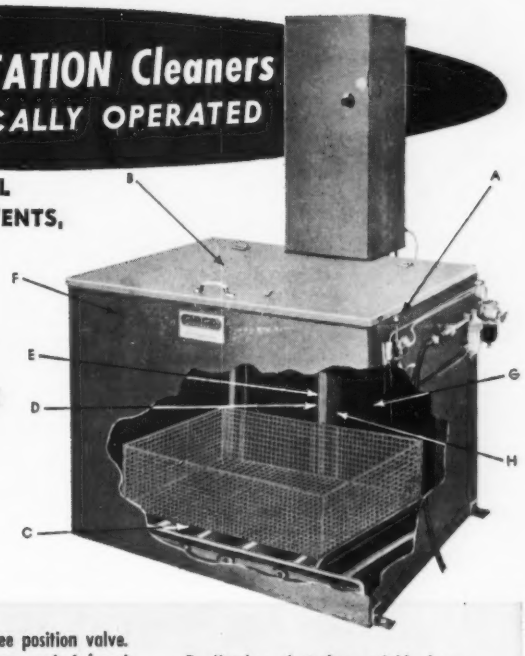
Republic Chem. Co., Dept. MF, 13068 Saticoy St., North Hollywood, Calif.

A non-electrolytic chemical process for finishing aluminum, called Recodizing, produces a grainy-structured satin finish on different types of aluminum alloys and is said to be both low in cost as well as highly corrosion resistant, being unaffected by all solvents, mild alkalies or acids. The firm also reports that treated surfaces can be refinished after years of outside exposure without removal from the installation.

Excellent paint bond ability without priming and high impact and abrasion resistance are characteristic of treated aluminum products. The finish is unaffected by rapid or slow temperature changes and the surfaces are electrically conductive and can be welded without discoloration. No visible or measurable metal change occurs during the process and, where bi-metallics are used, galvanic action is reduced.

Power AGITATION Cleaners
PNEUMATICALLY OPERATED

FOR USE WITH ALL CLEANERS — SOLVENTS, EMULSIONS, PHOSPHATIZING AND ACID SOLUTIONS FOR HEAT TREATING, QUENCHING, WAX AND PROTECTIVE COATING AND OTHER LIQUID PROCESSING.



A. Only one control—three position valve. 1. raises rack. 2. lowers rack for soak. 3. agitates rack.

B. Hinged steel cover. Fusible link causing lid to drop in event of fire, optional.

C. Supplied with grate platform. Roller rack platform available.

D. Length of up and down stroke variable from 4" to 27"

E. Number of strokes variable from 32 to 70 per minute.

F. Tank shell is fabricated of solid heavy gauge hot rolled steel.

G. Available with immersion heating choice of steam - gas or electric.

H. The same air operated piston lowers, raises and agitates the rack.

Since 1923 CIRCO **EQUIPMENT COMPANY**

Write for New 4-page Brochure with Complete Information on All Models.

51 TERMINAL AVE., CLARK, NEW JERSEY

Offices and Representatives in Principal Cities

OBITUARY

VAN WINKLE TODD

Van Winkle Todd, 66, Chairman of the Board of Directors of *Hanson-Van Winkle-Munning Company*, Matawan, New Jersey, died suddenly Thursday, January 15, at Monmouth Medical Center, Long Branch, New Jersey.

Mr. Todd was born in Newark, New Jersey, the son of the late Edmund N. and Anna Van Winkle Todd, and the grandson of the late Abraham Van Winkle, founder and President of The

Scores Greatest Popularity Gain in Finishing Metals!

SPIN-FINISH is only two years old, but is already an accepted method for finishing intricate design automotive, building, appliance and plumbing hardware. This revolutionary process produces in quantity surfaces and lustre equal to or surpassing that of buffing. Spin-Finish is a completely dry process. It is dust and fume free, and requires no set-up time!

Call on the free help of Grav-i-Flo engineers for savings in your finishing operation!

GRAV-I-FLO CORPORATION • DEPT. MF-2 • STURGIS, MICHIGAN

Hanson & Van Winkle Company of Newark, New Jersey. Mr. Todd was President of this Company at the time it merged in 1927 with A. P. Munning & Co. of Matawan, New Jersey. He was President of the Hanson-Van Winkle-Munning Company from 1927 to 1948 and Chairman of its Board of Directors from 1948 until his death.

Mr. Todd was graduated from Lawrenceville School in 1911, and was a member of the Princeton University Class of 1915. He served in World War I as First Lieutenant of the 103rd Aerial Squadron and saw service in France.

Mr. Todd married Frances Loraine Timpson of Orange, New Jersey, in 1914.

Surviving are his wife, Mrs. Frances Loraine Todd; four daughters, Mrs. Barbara Todd Townsend of McLean, Virginia; Mrs. Phyllis Todd Ellis of Gig Harbor, Washington; Mrs. Margaret Todd Boots of Lincroft, New Jersey; and Mrs. Anne Todd Ashley of San Anselmo, California; ten grandchildren; and two brothers, Nelson Todd of Middletown, New Jersey; and Edmund N. Todd of Miami, Florida.

Mr. Todd was a member of the Essex Club, Newark; Princeton and Whitehall Clubs, New York City and The Electrochemical Society.

Mr. Todd was one of the early members of the Newark Branch of the American Electroplaters' Society, taking part in the activities as an active member of the branch for 45 years.

BUSINESS ITEMS

Joan Trumbour Wiarda Elected President of Metals and Plastics Publications, Inc.

Joan Trumbour Wiarda

The directors announce that at a recent meeting *Mrs. Joan Trumbour Wiarda* was elected president of *Metals and Plastics Publications, Inc.*, publishers of METAL FINISHING, succeeding *Mrs. Louise H. Langdon* who resigned because of ill health. Her father, the late *Thomas A. Trumbour*, was general manager of the firm for many years. The company was founded in 1903 as the Metal Industry Publishing Co. by the late *Palmer H. Langdon*.

Mrs. Wiarda joined the staff October 13, 1923, after graduating from Benedictine Academy, Paterson, N. J., and later studied advertising and marketing at Columbia University. Her first duties were as a subscription clerk, then she was transferred to the advertising department. Her first activity in the American Electroplaters' Society was to attend the Newark annual convention in 1926 and, since that time, she has missed only three A.E.S. conventions. She is also a member of the National Industrial Advertisers Assoc. and the Women's Advertising Club of Chicago.

Mrs. Wiarda has called on almost every manufacturer and distributor of

metal finishing equipment and supplies in the United States and Canada. In 1954, she attended the International Conference on Electrodeposition in London and visited approximately 40 metal finishing plants in England, Holland, Belgium, France, Italy, Germany and Switzerland. She is co-author of "Finishing in the Heart of Industrial Europe," published in August 1954.

Du Pont Establishes Shipping Point in Carteret, N. J.

Du Pont Electrochemicals Department has established a new shipping point at Carteret, N. J., as the first step in a program to speed delivery of chlorinated solvents.

The Carteret bulk terminal will receive trichlorethylene by barge from the company's Niagara Falls, N. Y., plant and will supply metropolitan New York, Connecticut, New Jersey, and eastern Pennsylvania. A similar shipping point will be established in Los Angeles shortly after the first of the year. The firm manufactures chlorinated solvents at its Niagara Falls, N. Y., and Wyandotte, Mich., plants.

New Sales Rep for Pioneer Rubber

Pioneer Rubber Company of Texas has announced the appointment of *Jerry Kellam* as their new sales representative with headquarters in New Orleans, La.

Mr. Kellam has had extensive experience in the field of industrial merchandising previous to his joining the company. His territory includes Arkansas, Louisiana, Mississippi, western Tennessee and the Houston, Texas area.

A native of Alexandria, La., Mr. Kellam is a graduate of Louisiana State University.

Jerry Kellam

Photo courtesy Hanson-VanWinkle-Munning Co.

STOP CORROSION and CONTAMINATION

Where you use corrosive acids and other chemicals for pickling and metal plating be sure it's Manhattan Rubber Linings that protect your costly equipment. Thick, multiple calendered sheets of natural or synthetic rubber are bonded to tank metal so securely they can't be separated! Manhattan Rubber Linings eliminate the dangers of stray currents in plating operations. They expand and contract with metal . . . won't harden, crack or oxidize — even under extreme temperature change. To assure lifetime protection, every Manhattan rubber lined tank is tested under high voltage to detect any possible imperfections before being shipped.

Get the kind of *permanent protection* that has kept many Manhattan Rubber Lined tanks in continuous use over thirty years. Specify "Manhattan" on your equipment. Contact the Manhattan rubber lining facilities nearest you.

MULTIPLE CALENDERED SHEETS
•
PERMANENT RUBBER-TO-METAL BOND
•
POSITIVE PROTECTION FROM STRAY CURRENTS

RM-924

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose
Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles
Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Pangborn Appoints Sales Engineer

Pangborn Corp., Hagerstown, Md., manufacturers of abrasives, blast cleaning and dust control equipment has announced the appointment of *William M. Harper* as sales engineer in the Cleveland district office. His headquarters will be at 9802 Euclid Ave., Cleveland, Ohio.

Harper has been previously associated with the Ford Motor Co. as a plant engineer in the Cleveland foundry. He received his Bachelor's degree in Industrial Engineering from Ohio State and a Master's degree in Business Administration from Western Reserve.

Diversey Buys British Corporation

Diversey Corp. of Chicago, manufacturer of chemical products and detergents for industrial use, acquired their fifth new company this year in a world-wide expansion program with the purchase of Deosan Ltd. in London, England. The English company was purchased for approximately $800,000 from Vick International Ltd. (a unit of the Vick Chem. Co.). The stock of Deosan Ltd. will be owned by Diversey Corp. (United Kingdom) Ltd., a wholly owned subsidiary.

Udylite Appoints Sales Engineer for Southwestern Territory

Udylite Division of *The Udylite*

Marcel W. Courvoisier

Corp., announces the appointment of *Marcel W. Courvoisier* as sales engineer to serve in the Southeastern territory. Born in New York City, Marcel attended New York University, majoring in electrochemistry. His experience includes metal finishing supervision in manufacturing plants and sales service of equipment and processes in the field. His headquarters will be the Atlanta office at 1841 Cheshire Bridge Road, N.E.

Rinshed-Mason Co. Buys Controlling Interest in Wolverine Finishes Corp.

The purchase of a controlling interest in the *Wolverine Finishes Corp.* has been announced by *Rinshed-Mason Co.* of Detroit, Mich.

Wolverine is a manufacturer of custom wood finishes for use largely by the furniture manufacturing industries. Wolverine employs about 100 people and maintains plants in Grand Rapids, Mich., Morgantown, N. C. and Louisville, Ky.

Rinshed-Mason employs 750 people and has plants in Detroit, Mich., Anaheim, Calif., and Windsor, Canada, and is a manufacturer of all types of industrial finishes, with sales of approximately $25,000,000.

It is buying the controlling stock interest from *Earl M. Dunbar*, retiring president, and from the estate of *Max Johnson*.

Trent Elected Pangborn President

Ralph M. Trent has been elected president of *Pangborn Corp.*, Hagerstown, Md., manufacturers of blast

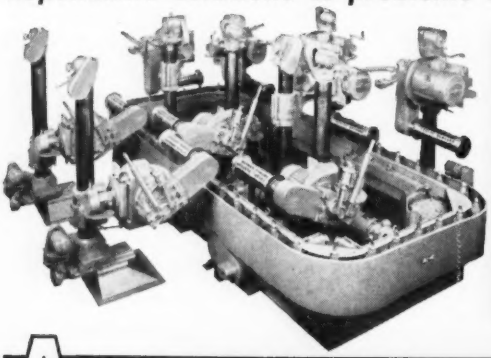
Ralph M. Trent

cleaning abrasives and dust control equipment. The appointment fills the unexpired term of *Victor F. Stine*, recently deceased.

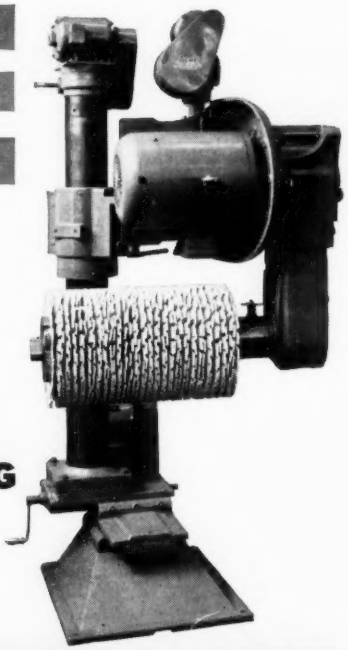
Mr. Trent has been associated with the firm for 28 years. He was district manager in Pittsburgh, Pa., for 14 years and West Coast district manager for 10 years. In January, 1957 he returned to the home office as executive vice president.

ACME

Automatic Polishing and Buffing Machines provide dependable solutions to problems of:



POLISHING
BUFFING
GRINDING
WIRE BRUSHING
DE-BURRING
MICRO-FINISHING



ACME MANUFACTURING COMPANY • 1400 E. 9 MILE ROAD, DETROIT 20, (FERNDALE) MICHIGAN

BUILDERS OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

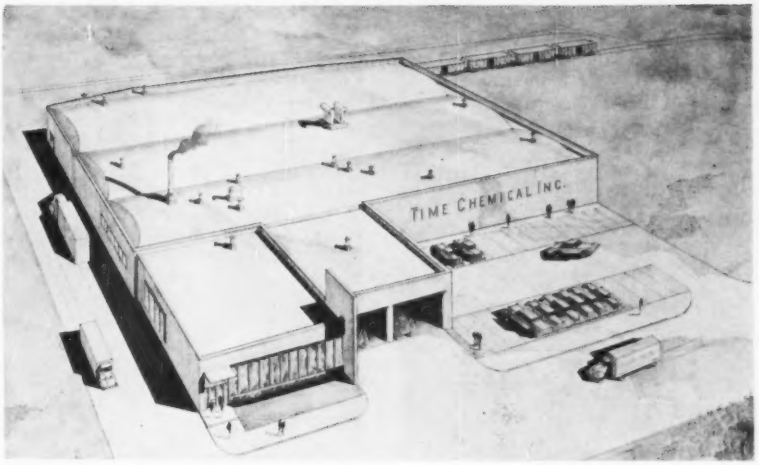
E. S. Nickerson Retires

E. S. Nickerson elected to retire recently as general manager of the *Du Pont Company's* Fabrics and Finishes Department, after a career of 43 years. The company also announced that *Walter F. H. Mattlage*, assistant general manager of the department, succeeded Mr. Nickerson as general manager.

Mr. Mattlage joined the company in 1928 as a mechanical engineer at the Newburgh, N. Y., coated fabrics plant. He was appointed production superintendent of the plant in 1937 and, in 1941, was transferred to Remington Arms Co., a Du Pont subsidiary.

Mr. Mattlage was appointed manager of the Fabrics Division in 1952, and was promoted to assistant general manager of the Fabrics and Finishes Department in 1953. A native of Brooklyn, N. Y., he attended M.I.T., where he received the degree of bachelor of science in mechanical engineering in 1928.

Time Chemical Builds New Chicago Plant



Time Chemical, Inc., Chicago manufacturers of private label and specification detergents and sanitation chemicals for industrial and institutional use, recently broke ground for a modern one-story plant at 3950 S. Karlov Ave. in Chicago's Central Manufacturing District.

The structure, to contain 43,000 square feet of floor space and scheduled for partial occupancy in March will be more than twice the size of the company's present headquarters at 4344 S. Wolcott Ave. The new building, replacing the present plant, will house the company's offices, manufacturing and warehousing for the Chicago area.

Koop Appointed General Sales Manager by Tect, Inc.

Appointment of *William H. Koop* as general sales manager has been announced by *Tect, Inc.* of Northvale, N. J. He will assume full responsibility

for the "Solution to your Plating Problems" .... come to

JELCO

BRASS ADDITIVE . . . *can be used in standard & high speed formulations — still & barrel plating*

One of America's leading manufacturers
- BRASS Additive
- COP-BRITE
- BARREL COPPER Brightener
- BARREL NICKEL Brightener

- Increases efficiency and throwing power
- Produces brighter and faster plating
- Allows use of higher current density
- Retards anode polarization
- Eliminates cyanide and ammonia fumes

A Proven Process!

Used successfully by job platers and manufacturers

NON-CRITICAL
BOOSTS PRODUCTION
CUTS REJECTS

For technical information, complete details and prices . . . write to

JELCO Finishing Equipment Corp.
153 East 26th Street, New York 10 • Phone LExington 2-3055

William H. Koop

for the distribution of the firm's line of safety solvents and detergents throughout the United States and in Canada.

Mr. Koop is a graduate of the University of Washington and served with the Navy Air Corps in World War II. He comes to the firm from the George S. May Co., business consultants, and was previously sales manager for the Western Chemical Co. and Buitoni Foods Corp.

U.S. Rubber Appoints Applicator for Permabond

Field Erection and Welding Co. has been named a franchised applicator of U.S. Permabond tank lining by *United States Rubber Co.*

The protective linings division of the Texas company is located at 6322 West 34th St., Houston.

Consultant Moves to New Quarters

Norman I. Gaynes, consultant in the industrial coatings, lacquering and enameling field, announces the removal of his offices to 48 Whitney Drive,

Norman I. Gaynes

Berkeley Heights, N. J., telephone — Fanwood 2-2063.

Polymer Announces Availability of Licenses

To meet the widespread and growing demand for use of the patented fluidized bed process to coat metals with plastics, process rights have been made available to all purchasers of Corvel fusion bond finishes, *The Polymer Corp.*, of Reading, Pa. has announced.

Polymer Processes, Inc., a subsidiary which has exclusive licensing rights in the United States, had previously made process rights available to selected licensees only. Under the new program, purchasers of the resin powders will automatically be licensed by Polymer Processes to use the fluidized bed process. Other forms of license will continue to be available.

V. P. Dolan & Co. Adds to Facilities

V. J. Dolan and Co., Inc., 1830 N. Laramie Ave., Chicago, Ill., have just completed installation of additional storage tanks to accommodate their increased production requirements.

They have also installed new and modern high speed cutters and mixing equipment within the past 60 days.

Jones Appointed Director of Market Development at Michigan Chrome & Chemical Co.

Frank Jones

Michigan Chrome & Chemical Co. of Detroit, Mich., announces the appointment of *Frank Jones* as director of market development.

Mr. Jones has served in the capacity of manager of the firm's Coating Division, assistant sales manager, Chemical Division, and sales representative in the East. In his new assignment, he will be responsible for developing new markets for the company's plastisols, fluidized bed resins and other organic coatings.

Enthone Builds New Research Laboratory

Enthone, Inc., has just completed a new research laboratory at its main

DEPENDABLE PPI PRODUCTS

PLATING RACKS
RUBBER DRUM LINERS
ACID CONTAINERS
ANODE HOOKS
FIBERGLAS TANKS
DUCTS & HOODS
PLASTIC COATED DIPPERS & PAILS
STEEL & STAINLESS STEEL TANKS
LEAD & PLASTIC LINED TANKS
POLYETHYLENE PAILS & CONTAINERS
FUME SEPARATORS
PLATE COILS
LEAD ANODES
DEGREASING SOLVENTS
SILVER BRIGHTENER

NEW • STURDY • LIFETIME

PPI Titanium Scrap Saver Anode Baskets

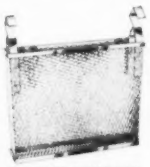
Completely Made of Titanium Metal with Rugged Welded Frame . . . Built to Last Almost Indefinitely When Used in Nickel or Acid Copper Plating Solutions

Advantages that will make you money . . . . . .

- Nickel and Copper anode scrap makes perfect electrical contact to titanium basket and draws full current
- Solutions have no effect on titanium metal either with or without current
- Eliminates the hazards of plating failures that occur when using plastisol coated steel baskets
- Eliminates all possibilities of iron contamination

NOTE: Titanium metal can't be used in cyanide or fluoborate solutions

Titanium Scrap Saver Baskets are made in graduated sizes . . . write today for prices, details, and advise us of your requirements.



PATENT PENDING

A Few PPI Territories Open For Distributors . . . write for details

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

Views of New Laboratory.

plant in New Haven, Conn. The laboratory, one of the most modern and well equipped in the field, triples the firm's research facilities, and will conduct both basic research and applications research programs.

The three-story building has been designed to provide the research staff with a broad range of functional facilities and conveniences. The first floor is devoted to an exceptionally flexible pilot plant laboratory; the second floor comprises technical service, product evaluation and basic research laboratories; the third floor includes laboratories for specialized research and the main library and conference room. The building is extensively air conditioned.

One of the largest sections of the expanded research facilities is the pilot laboratory. It is set up to closely approximate actual plant operating conditions and will be used to study problems in plating, cleaning, blackening, acid dipping, paint and metal stripping, alkaline derusting and descaling, degreasing, buffing, tumbling rust and tarnish inhibition. So that a maximum number of different experiments can be carried through simultaneously, each of the 41 plating tanks has individually controlled rectification and temperature control. Each tank has a capacity of 40 gallons.

Roto-Finish and Ransohoff Have Combined

Two of the oldest and largest companies manufacturing machinery for the surface treatment of metals have recently combined. *Roto-Finish Co.*, of Kalamazoo, Mich., manufacturers of precision barrel finishing machinery, has announced the purchase of *Ransohoff, Inc.*, Hamilton, Ohio. Ransohoff manufactures metal finishing, phosphating, pickling and paint finishing systems, foundry equipment including foundry mills and automated combinations of this equipment.

No material changes are contemplated in the personnel or the operations now being conducted at the Hamilton plant. *R. E. Wigger*, vice president of Ransohoff, will be in charge of operations as executive vice president of the new Ransohoff Co.

Gunther W. Balz, president of the combined companies, stated the acquisition of Ransohoff by his firm will provide engineering and manufacturing facilities for a complete line of metal treating machinery for companies in the United States and abroad.

New Regional Sales Manager for International Rectifier

International Rectifier Corp., El Segundo, Calif., has appointed *Neil DeFazio* as regional sales manager over its western sales region. DeFazio

Neil DeFazio

will manage the activities of all sales groups in California and the western states.

Before being appointed regional sales manager, DeFazio served as head of the company's Commercial Products Department. He has an extensive background as components engineer and sales executive, including five years as sales engineer in the New York area.

DeFazio attended Columbia University in New York and the Paterson Radio Institute in Paterson, N. J.

Industrial Filter Appoints Vice President

The appointment of *Arthur E. MacQuilkin* as executive vice president and general manager has been announced by *Industrial Filter & Pump Mfg. Co.*,

DEPENDABLE PPI PRODUCTS

PLATING RACKS
RUBBER DRUM LINERS
ACID CONTAINERS
ANODE HOOKS
FIBERGLAS TANKS
DUCTS & HOODS
PLASTIC COATED DIPPERS & PAILS
STEEL & STAINLESS STEEL TANKS
LEAD & PLASTIC LINED TANKS
POLYETHYLENE PAILS & CONTAINERS
FUME SEPARATORS
PLATE COILS
LEAD ANODES
DEGREASING SOLVENTS
SILVER BRIGHTENER

NEW • DURABLE • LIFETIME

PPI TITANIUM ANODE HOOKS

This New Titanium Anode Hook Is Almost Indestructible When Used With — Nickel, Chrome, or Acid Copper Plating Solutions

Advantages that will save you money . . .

- No chemical or electrochemical attack on titanium hooks by plating solution
- No foreign metal to contaminate solution from the titanium hooks
- Titanium hooks can be placed completely under plating solution level . . . thus, minimizing scrap loss
- Hook threads will not decompose in plating solution
- No electrolysis on the surface of titanium that is exposed to the solution; therefore, hooks will not generate gas or decompose brighteners

NOTE: Titanium metal can't be used in cyanide or fluoborate solutions

Titanium Anode Hooks are made of 3/8" square stock in 3 1/2" thru 8" graduated lengths to fit 1 1/2" dia. anode rod size or less. Special size hooks quoted upon request. PPI makes a complete line of anode hooks . . . Write today for prices and complete details.

PATENT PENDING

A Few PPI Territories Open For Distributors . . . write for details

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

Cicero, Ill., manufacturer of filter systems, ion exchangers and waste treating equipment.

Mr. MacQuilkin joined the company in 1946 and has served as controller and secretary. He is also vice president of the Cicero Manufacturers Assn.

New Precision Plating Firm

Fred R. Davino, president and founder of *Plating for Electronics, Inc.*, 249 Lexington St., Waltham, Mass., has announced the development of new and improved techniques for precision plating of precious metals for the electronics and related industries.

Mr. Davino formerly was employed by the Raytheon Mfg. Co., Missile Systems, where he was in charge of the research and development plating laboratory. His vast experience includes the development of techniques for electroforming, spray metalizing and spray coatings, plating non-conductors including ferrites, etching and plating printed circuitry, chemical milling and deburring, electro and chemical polishing, hard coat anodizing on magnesium and aluminum, plating on aluminum, magnesium, manganese, tantalum and molybdenum for soldering and brazing purposes.

Fred R. Davino

In the new modern facilities, using the latest plating equipment, emphasis will be on precision plating to specifications of precious metals such as gold, silver and rhodium; anodizing; and precision plating of cadmium, nickel and copper.

Branson Ultrasonic Names New Sales Manager

H. F. Osterman has been appointed sales manager for *Branson Ultrasonic Corp.* of Stamford, Conn.

Before joining the firm, Mr. Osterman was a research engineer for Jones & Laughlin Steel Corp. His major project for the past four years has been the study of ultrasonics, as applied to steel mill problems.

A graduate of Carnegie Institute of Technology (BS, physics), Mr. Osterman is a member of the American Institute of Physics, Optical Society of America, and the Instrument Society of America. He is also a member of the Advisory Group on Ultrasonic Cleaning Standards as well as the Committee on Sonic and Ultrasonic Equipment of the Accoustical Society of America.

Zinc Rich Paint Offered by Bart

Bart Mfg. Corp., Belleville, N. J., has announced the introduction in this country of "Galvafroid," a zinc rich paint containing from 92% to 95% of metallic zinc in the dry film, and giving protection comparable to hot-

NUGLU

THE IDEAL ADHESIVE

For Setting Up or Recoating Polishing Wheels, Abrasive Belts & Discs

Nuglu, a liquid glue, developed to lengthen wheel life — produce a better finish, and increase metal finishing production.

BRUSHING NUGLU

A mixture of Nuglu and graded aluminum oxide grain —

Save on operating costs, **increase** production, **reduce** wheel inventories, and obtain **greater** results, with less costly materials, in fine polishing work!

Ask for **information on The Siefen Finishing Systems — Also for better metal finishing use Siefen Compositions • Stainless Steel • Bar (Grease) in Tube • Liquid Tripoli • Liquid Grease • Lapping Compound • Burring Compound.**

Siefen For Service

J. J. SIEFEN CO.

5643 LAUDERDALE, DETROIT, MICH.

1927 Our Thirty-First Year 1958

This Exclusive SURETY GLOVE COMBINATION SOLVES MORE HAND PROTECTION PROBLEMS *than any other we know*

SURETY

SURESEAL (HYCAR) TURN-CUFF INDUSTRIAL GLOVES

Tests prove Sureseal's amazing long life—ten times and more wear than other materials. Since Surety makes gloves from all materials you may be sure of test impartiality. Adding Surety's famous safety feature, Turn-Cuffs, the barrier to dangerous liquids, provides the maximum hand safety and comfort to make willing hands and willing workers. Ask your jobber or write Dept. BW. The Surety Rubber Co., Carrollton, Ohio.

TEST *at our expense*

Send for slide rule showing gloves best to resist chemicals, acids, oils, solvents, etc. Tell us your glove need, too . . . we'll send sample pair.

In Canada: Safety Supply Co., Toronto

dip galvanizing. It is producing the paint for distribution in the United States and its possessions, under an exclusive license from *Secomastic Ltd.*, Bracknell, Berkshire, England.

Macarr, Inc., Acquires Walker Rectifier Division of Norma Hoffman

Macarr, Inc. and Walker Division of *Norma Hoffman* have jointly made formal announcements that Macarr received all Walker inventory, engineering data, and customer files as of November 30, 1958.

This transaction was initiated in order to maintain continuity of maintenance, service and replacement parts for all Walker equipment now in the field. All inquiries concerning Walker Division equipment should be forwarded to Macarr, Inc., 2543 Boston Road, Bronx 67, N. Y.

Rodgers Promotion Announced by The Pfaudler Co.

Appointment of *Lawrence C. Rodgers, Jr.*, as product manager, special metals fabrication, has been announced by *The Pfaudler Co.*, a division of

Lawrence C. Rodgers, Jr.

Pfaudler Permutit Inc. He will be responsible for promotion and sales of tantalum, titanium and zirconium equipment through the company's vessel sales department.

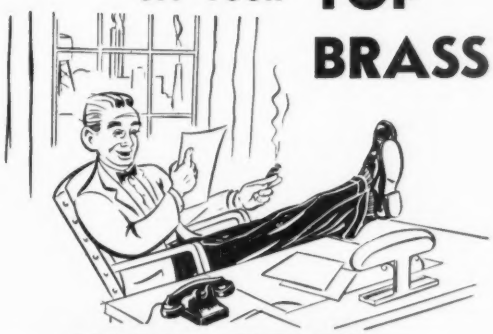
Before assuming his position, Rodgers was a member of the sales force in the Houston, Tex., area. Prior to joining the company, he worked as a sales engineer. A native of Texas, Rodgers is a graduate of Texas A & M. He served with the Air Force as a pilot and electronic officer.

International Rectifier Appoints Regional Sales Manager

In a program aimed at shortening the line of communication between customer, field personnel and home office, *International Rectifier Corp.*, El Segundo, Calif., has appointed *Arno Nash* regional sales manager over the Eastern Division of the company's nationwide sales organization. Nash will take command of sales forces in New York State, New Jersey, New England, Pennsylvania, and southern states along the eastern seaboard. Prior to his new appointment, he served as district manager of the New York office. He received his B.E.E. degree from Cornell University, and did graduate work at Rutgers University before coming with the company.

After serving in the U. S. Navy as an electronics engineer, he became a member of the technical staff of the Signal Corps Engineering Laboratories at Fort Monmouth, N. J., where he was

TAKE THE **LOAD** OFF YOUR **TOP BRASS**



USE **TRUE BRITE BRASS SOLUTIONS**

Trouble Free — Low Cost
Little Supervision Needed
Ready To Use — Just Add Water
Uniform Color — Can Match Colors

Write For Bulletin on Brass Plating

TRUE BRITE CHEMICAL PRODUCTS CO.
BOX 31, OAKVILLE, CONN.

Sethco Epoxy Filter Chamber **DEFIES Chemical Attack & Heat!** ... up to 250° F

dynel filter tubes, stainless steel center rod, self-priming SS 316 pump

trouble-free DEPTH FILTRATION for problem solutions

Sethco MODEL ASIN-400
FILTER PUMP UNITS

No more difficult hard-to-handle solutions. Hot, highly concentrated acids or alkalies filter fast and clear through these specially designed Sethco Filters. Non-porous, heavy duty construction and automatic reversal for self-washing. Portable, low cost operation.

Over 25 other models— 50 to 3000 gals./hr.

Write for illustrated Fact Folder

SETHCO MFG. CO., 2286 Babylon Turnpike, Merrick, N. Y.

Arno Nash

engaged in research and development of semi-conductors, resistors and attenuators.

He is an associate of the Institute of Radio Engineers and the American Institute of Electrical Engineers.

Oakite Names New Representatives

J. D. Rodgers and *R. A. Nederman* have been named technical service representatives of *Oakite Products, Inc.*, in Houston and Kansas City, respectively.

Rodgers, a graduate of Texas Tech, replaces *Ed Lacy*, who retired recently after 37 years with the firm. Nederman, who was educated at the University of Minnesota, is a native of Kansas City. Both men completed an intensive eight-week training course in the field and the company's laboratories.

Neal to Represent Engelhard Industries, Inc.

Thomas E. Neal has been appointed general sales representative of *Engelhard Industries, Inc.*, in a four-state area of the United States. He will maintain sales contacts with the customers of all the firm's divisions and associated companies in Florida, Alabama, Georgia and South Carolina. His address is P. O. Box 1191, New Smyrna Beach, Fla.

Changes at Egyptian Lacquer

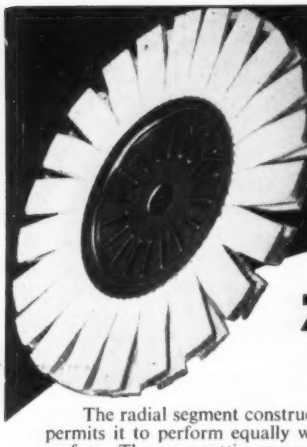
Effective last month, *William H. McLeod* became assistant general manager of the South Kearny, N. J., plant of *The Egyptian Lacquer Mfg. Co.*

Robert E. Mellor, with whom many of the firm's suppliers are well acquainted, will resume his former position of purchasing agent.

Drying Systems Co. Elects Russell

B. Arthur Russell, executive vice president since 1953, has been elected president and treasurer of *Drying Systems Co.* of Chicago, a division of

B. Arthur Russell



"A Flexible and Resilient Buff for Flat or Irregular Surfaces"

FORMAX

ZIP-TIP BUFFS

The radial segment construction of the Zip-Tip Buff permits it to perform equally well on flat or contoured surfaces. The cross-cutting movement of the spoke-shaped segments prevent work streaking while it breaks up straight-line patterns on the surface.

- Zip-Tips are available in a wide variety of all cloth constructions —also combinations of cloth and sisal.
- Zip-Tips are made of heavy-duty, bias-cut materials mounted on ventilated steel centers.
- Zip-Tips are extra thick and provide wider buff faces with greater compound retention capacity.
- Zip-Tips are perfectly balanced —require no raking.

Write for Descriptive Literature

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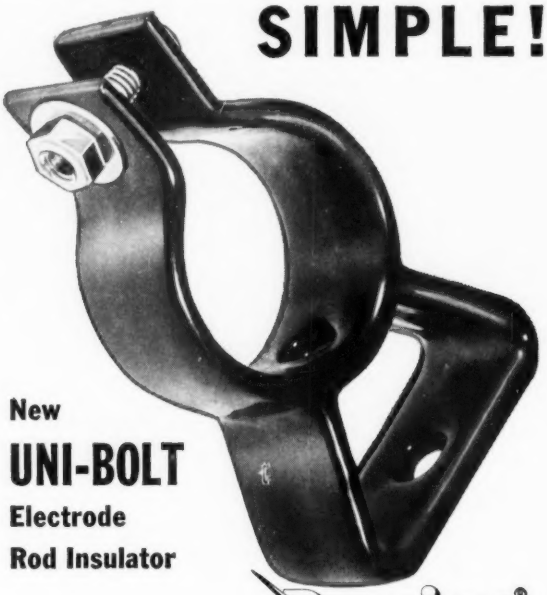
DETROIT 7, MICHIGAN
"THE FOUR McALEERS"

SIMPLE!



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UNI-BOLT
Electrode
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One-piece steel, heavily coated with plastisol... no spacer needed. Easy to install. Universal application. Standard sizes stocked. For details, call or write

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4160 Meramec St. ST. LOUIS 16, MO.

Branches:
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Kansas City 8, Mo.,

2547 Farrington,
Dallas 7, Tex.,

Thor Power Tool Co. *Buford B. Russell* becomes chairman of the board of directors after 24 years as its president and general manager.

Kelite Corp. Appoints Chalfant

Charles N. Chalfant has been appointed product manager-metal finishing by *Kelite Corp.*, manufacturer of metal processing compositions, industrial chemicals, and steam cleaning equipment. He will be responsible for development of metal finishing sales in the Midwestern and Eastern regions, and will report to *William Sorensen*, marketing director.

Charles N. Chalfant

Mr. Chalfant has been active in laboratory and sales work in the metal finishing industry for the past 30 years. He holds a bachelor of science degree in chemistry from Carnegie Tech, and is a member of the American Electroplaters' Society. Most recently, he has been employed in technical sales by the company.

New Sales Engineer for Graver's Chicago Office

Garth E. Pehrson has been named sales engineer for the Chicago district office by *Graver Water Conditioning Co.* The office is at 228 No. La Salle St., Room 1615. Telephone CEntral 6-4709.

Mr. Pehrson is a liquid treatment engineer with wide experience in the practical and theoretical aspects of equipment design, application and operation. Prior to his appointment he was a process engineer in the sales department for two years. Before that he was a member of the service department for three years. Mr. Pehrson's background includes a post as assistant to the chief of engineering with a prominent pharmaceutical firm. He holds a Bachelor of Science Degree from Brigham Young University in Utah and has done graduate work there

Garth E. Pehrson

UNIVERTICAL
HIGH PURITY ANODES
ROLLED, FORGED and CAST
Nickel - Copper - Zinc - Tin - Lead
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UNIVERTICAL'S NEW ROLLED COPPER ANODES FOR ACID BATHS!

The largest automotive impact Bar Platers in the world report a new high in uniformity and performance, along with a better end product.

OPEN THE DOOR RICHARD! and let yourself in for better than ever acid copper plating.

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ELECTRO-BRITE COPPER for CYANIDE BATHS

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air dry lacquer

for additional adhesion.

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SERVING INDUSTRY SINCE 1927
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THE LAST WORD IN QUALITY

and at Georgetown University, Washington, D. C.

G. S. Equipment Promotions

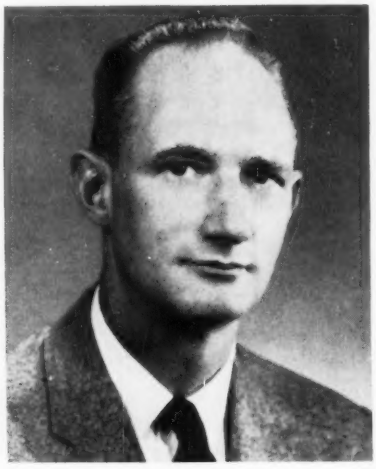
Keynoting a major expansion at the *G. S. Equipment Co.* and affiliates are the promotion of *Carel H. Neffenger* to general sales manager, and appointments of *Robert F. Pyle*, *George D. Stevenson*, and *Arthur W. Reckling*, as district sales managers.

Neffenger, active in general sales for the firms since 1953, takes charge of the increased sales administration responsibilities due to recent additions to lines and extended territorial coverage. His office is at the Cleveland plant.

Mr. Pyle serves West Side Cleveland and Central Ohio area. Formerly with Heil Equipment, and more recently with International Plastics, he is experienced in plastics, plating, plant layout and equipment manufacturing.

Stevenson manages district sales in East Side Cleveland, Eastern Ohio, and Western Pennsylvania. He formerly worked for Frederic B. Stevens, and

Carel H. Neffenger



Robert F. Pyle

George D. Stevenson

PAINT STRIPPING CLINIC!

Send Us Your Tough Stripping Problems for Fast Action!

10 YEARS OF BECK PAINT STRIPPING CLINICAL SERVICE Saves Thousands of $$$ for Customers—Who Now Use World-Famous...

EPOXYSTRIP

Better find out for yourself . . . about Epoxystrip, Econostrip and other Beck Paint Remover lines and formulations. Use the BECK CLINIC SERVICE — send us several parts, sections, or test panels (properly tagged) of the work to be stripped.

Write or 'phone giving us essential information—your problem details, requirements, tanks available, hot or cold, etc. This service, and our prompt report, are free, with no obligation.

Beck Strippers outstrip all others — removing organic finishes, epoxies, etc., as easily as baked enamels, lacquers, etc. No stripping scum — clean rinsing!

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WHY NOT CUT COSTS, INCREASE PRODUCTION and IMPROVE QUALITY!

Model 209 CLAIR Pinch-Roll Thru-Feed Surface Finishing machine will handle any and all types of sheet or coil stock up to 40" wide. Takes any thickness from extremely light gauge to heavy plate for all degrees of finishing. Truly an incredibly versatile finishing machine ready to solve almost any problem you might be having with elementary metals, alloys, woods, laminated surfaces, plastics, printed circuitry, etc., etc.

Model No. 209 can be reset in a couple of minutes for any operation such as: coarse stock removal, satin finishes, highly colored mirror surfaces, polishing, buffing, cleaning, delustering, brushing, waxing, etc., or, the equivalent of wide abrasive belt applications with the patented spiral wrap abrasive roll. Rate of pinch roll feed is easily and quickly adjustable.

CLAIR
MANUFACTURING CO., Inc., OLEAN, N.Y.
Offering the Most VERSATILE Line of Surface Finishing Machines

later became a representative for Hoover Ball Bearing. Pyle and Stevenson also make their headquarters at the Cleveland plant.

Reckling, with headquarters in Detroit and Livonia, Mich., manages district sales for G. S. Equipment and G. S. Plastics in Northwest Ohio, Eastern Indiana, Southern Michigan, and Detroit. He serves jobbers only in the motor city and deals direct with the field in the other areas. Formerly with Sel-Rex Corp. as sales representative, his previous experience was gained coming up through plating ranks at Atlas Plating.

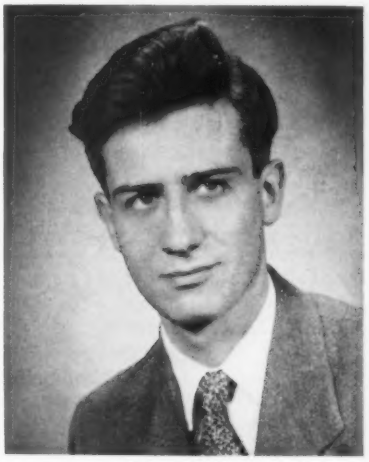
Enthone Adds to Staff

Harry K. Tsourmas and *Thomas Wolf* have joined *Enthone, Inc.* of New Haven, Conn. as research chemists.

Mr. Tsourmas received the Bachelor of Science degree in chemistry from Columbia University in 1949 and is presently doing graduate work in metallurgy at Stevens Institute of Technology, Hoboken, N. J. He has had nine years of experience as electroplating

Arthur W. Reckling

Harry K. Tsourmas



Thomas Wolf

Looking for a Better Finish?

Try
HARRISON'S

4A

Tailor-Made
CAKE AND LIQUID
BUFFING & POLISHING COMPOUNDS
for

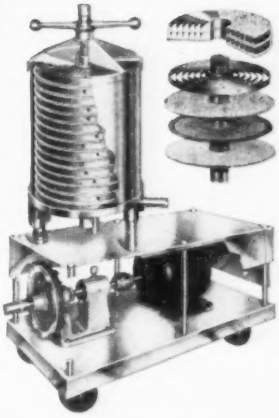
Aluminum, Brass, Copper, Stainless Steel,
Carbon Steel, Plastic, Wood, etc.

EMERY CAKE, GREASE STICK, TRIPOLI
POLISHING CEMENT AND THINNER
for setting up wheels, belts and rolls

HARRISON & COMPANY, INC.
P. O. Box 457
HAVERHILL, MASSACHUSETTS

ELIMINATE COSTLY PLATING REJECTS

due to pitting or rough deposits!



Sectional view of "Sealed-Disc" filter and pump unit. Portable or fixed installations are available in a wide range of capacities.

The Alsop Method of "SUB-MICRON" filtration assures you of totally clean plating solutions at all times with no interruption in your plating cycle! *All* impurities are automatically removed as fast as they are formed or introduced.

ALSOP

FREE! Your guide to better plating. "The Use of Filters in Electroplating" by J. B. Mohler

ENGINEERING CORPORATION
1402 Bright St., Milldale, Connecticut

chemist and plating supervisor for several firms. He comes to Enthone from Insulated Circuits, Inc., Passaic, N. J. where he was in charge of specification plating and finishing of printed circuits.

Mr. Wolf graduated with honors from Trinity College, Cambridge, England, in 1956, receiving the Bachelor of Arts degree in chemistry. He was employed as a research chemist in the resin research laboratories of Coates Brothers and Co. Ltd., Kent, England and, after coming to this country, as a research group leader with Wymat Chem. Co., Harrison, N. J.

Tittmann Named Asarco V.P. and Director

Edward McLanahan Tittman has been elected a vice president and director of *American Smelting and Refining Co.*, and will be in charge of the smelting and refining operations.

Recently, Mr. Tittmann was elected chairman of the board and chief executive officer of Southern Peru Copper Corp., in which Asarco holds a majority interest. He will continue in that post in addition to his new duties.

Edward Tittman

A 29-year employee of the company, Mr. Tittman was born in St. Paul, Minn., in 1906. After attending preparatory school at the Stone School in Cornwall, New York, he studied at the Massachusetts Institute of Technology, graduating in 1929 with a B.S. degree. In September of that year he joined the company as a chemist in the laboratory of the Garfield, Utah, copper smelter. He rose through the ranks at Garfield, and in 1935 was named ore buyer and assistant manager of the Salt Lake City office. In 1941, Mr. Tittmann was moved to East Helena, Mont., to manage the smelter there. After six years in that post, he was named manager of the El Paso, Tex., plant. In 1952, Mr. Tittmann returned to Salt Lake City as general manager of the Western Smelting and Refining Department, remaining in that position until assuming the presidency of Southern Peru in 1955.

Mr. Tittmann is a member of Chi Phi fraternity, AIME and the Mining and Metallurgical Society of America.

Thanks for Your Christmas Cards!

At this time we would like to acknowledge and thank all those who, during the past month, have sent us Christmas cards, 1959 calendars, or other gifts and remembrances.

Acoustica
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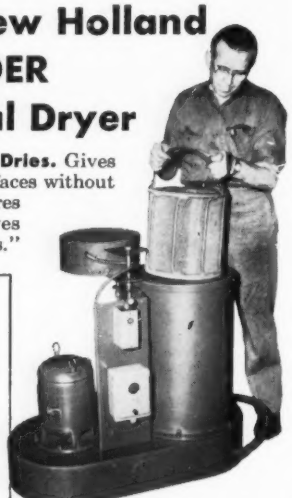
Drying time
CUT IN HALF!
with...
Model 20 New Holland KREIDER Centrifugal Dryer

Air-Dries . . . as it Spin-Dries. Gives smooth, moisture-free surfaces without scoring or marring... assures faster production . . . saves money wasted on "rejects."



SPECIFICATIONS:
1 hp motor—220, 440, 550 volts—2- or 3-phase. Spins 75-lb. loads at 825 rpm. Quiet V-belt drive. Arc-welded, steel-plate construction. Weight 490 lbs. Minimum floor space. Meets N.E.C. specs. Auxiliary electric or steam units available as optional equipment.

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SODIUM GLUCONATE and GLUCONIC ACID

Promptly available in any quantity.
Warehouse stocks across the country.
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Becker, Al
Beresford, L. G.
Bernard Chemical Products Co.
Briganti, Anthony
Briganti, Frank
"Car Load" Andy
Carlton-Cooke Plating Corp.
Celanese Corp.
Crane, Dick
Cushman & Wakefield, Inc.
Diamond Alkali Co.
Dodge Corp., F. W.
Doyle, Edwin
Draper, C. R.
Errico, Anthony
Ethiopian Airlines
Etkes Associates, Inc., Asher B.
Filon Plastics Corp.
Fotheringham, Inc., W. M.
Foulke, Don
Fusco, A.
GPE Controls, Inc.
Gardner Lab., Inc.
General Electric Co.
Gentieu, Norman P.
Goldwasser, Irving
Graham & Associates, Inc., Hugh H.
Graver Water Conditioning Co.
Hall, Dr. A. M.
Hall Industrial Publicity, Inc.
Hamilton Photo Engraving Co.
Hariton, Harry
Hartshorn, Derick
Hercules Powder Co.
Herramientas de Mano, S. A.
Hinterleitner, Ernest J.
Huston, Kenneth M.
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Industrial de San Bartolo, S. A.
International Rectifier Corp.
Jaqua Advertising Agency
Jumer, John
Kellner, Dr. Henry L.
Kelly, Clyde
Kim, Yona
Korbelak, Al
Kovatis, P. Peter
Kushner, Dr. Joseph
Lea of Waterbury
Maytag Co., The
Merchants Metal Trimming Co.
Michigan Buff Co., Inc.
Mohler, J. B.
Nadel, Milton
Oakite Products, Inc.
Ostrow, Barnet D.
PIC Design Corp.
Pannier Corp., The
Pesco Plating Equipment Corp.
Powers, John A.
Proudfoot, David M.
Quigley, Surles & Loughlin
Robotham Co., The Edw. W.
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Schore, George
Serota, Louis
Shaw, Ken
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Steiger, Andrew
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Veit, Peter
Vernon Plating Works
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Walter, John J.
Wein, Samuel
West Virginia Pulp & Paper Co.
Wheelabrator Corp.
Wooton, Paul
Young, Sol
Zell Products Corp., The

Manufacturers' Literature

Engineering Equipment

Industrial Filter & Pump Mfg. Co., Dept. MF, 5912 Ogden Ave., Cicero 50, Ill.

Bulletin GEN-58 illustrates and describes the firm's pressure filters, ion exchangers, demineralizers, water soft-

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. . . by taking advantage of modern trends in tank design and construction to get maximum benefits from development of better plating procedures. Storts engineering service will help you to utilize design and welding improvements that apply to your plating equipment needs. Forty years of experience in keeping plating equipment up to date is at your disposal.

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38 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

Electro-polishing

FOR BEAUTY, ECONOMY, SPEED

Fast, low cost finish for aluminum, copper and alloys, steel and stainless steel. Ideal for decorative finishes, burr removal, electroplate adhesion and size control. Standard and custom concentrates nationally available in any quantity.

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Let us convince you—send samples for processing.

Write for full data.

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eners, centrifugal pumps, heat exchangers and waste treatment systems, giving the characteristics and applications of each.

Precious Metal Scrap Recovery

Handy & Harman, Dept. MF, 82 Fulton St., New York 38, N. Y.

This bulletin describes the many forms of wastes in which valuable precious metals can be hidden, such as vacuum system dust, wiping rags, solutions, paper, sludges, powder mixtures, grindings, and turnings. The bulletin also lists specific types of scrap materials that have salvageable values. Often the return on precious metal waste is an important factor in reducing production costs, and many manufacturers, fabricators and processors include the return on refinings in computing their operating costs.

Mixer Bulletin

Infilco Inc., Dept. MF, Tucson, Ariz.

A new bulletin on mixers and mixing discusses the theory of mixing and compares the range of operations of different types of mixing equipment. The booklet, Bulletin 730, also contains tables which assist the engineer in the selection of mixer size for any specific application, depending upon the degree of mixing required. The material is clearly divided into discussions of rapid mixing, slow mixing, i.e. blending and flocculating, and gas dispersing mechanical equipment.

Strippable Vinyl Coatings

Pennsalt Chemicals Corp., Dept. MF, Three Penn Center, Philadelphia 2, Pa.

A new illustrated folder on strippable vinyl coatings includes an actual sample of the tough X-1000 strippable vinyl coating, and suggests application techniques, stripping, and some of the variety of uses for the product.

Belt Sanders

Timesaver Sanders, Dept. MF, P. O. Box 7446, Robbinsdale Station, Minneapolis 22, Minn.

A 4-page folder describes the Model TOP "Speedbelt" sander. It details the construction features of these wide abrasive belt sanders and finishing machines and the production advantages for users in the woodworking, metalworking and plastic industries. Complete specifications for 4 models, 24", 38", 50" and 64" belt widths are presented in chart form. Several applications are shown.

Test Service

South Florida Test Service, Inc., Dept. MF, 4301 N.W. Seventh St., Miami 44, Fla.

A leaflet is available from the above firm which outlines their scope, activities, facilities and services.

Impervious Graphite Pipe

Falls Industries, Inc., Dept. MF, Aurora Road, Solon, Ohio.

This bulletin describes new modular concept in corrosion proof impervious graphite pipe and fittings.

Dust Collectors

Torit Mfg. Co., Dept. MF, Walnut and Exchange Sts., St. Paul, Minn.

Information sheets on two cabinet cloth filter dust collectors describes models 64 and 66, compact, self-contained units. Photographs illustrate internal design and typical applications of the collectors.

The information sheets also include

PROVED in over 10,800 installations
For innumerable applications
BENCH TYPE OVENS
BATCH OVENS
GRIEVE-HENDRY OVENS
Standard models with temperatures to 1200°F.
$110.50 and up
Write for literature.
CABINET OVENS
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If you are manufacturing a product that requires HEAT — for baking, preheating, drying, etc., it will pay you to consult with us. STANDARD OVENS in most models available from factory stock. In addition, we design and build Ovens to your particular requirements — Gas — Oil — Electric — any shape — any size — to any specification.
CONVEYOR OVENS
Sales engineers in all principal cities and many foreign countries.
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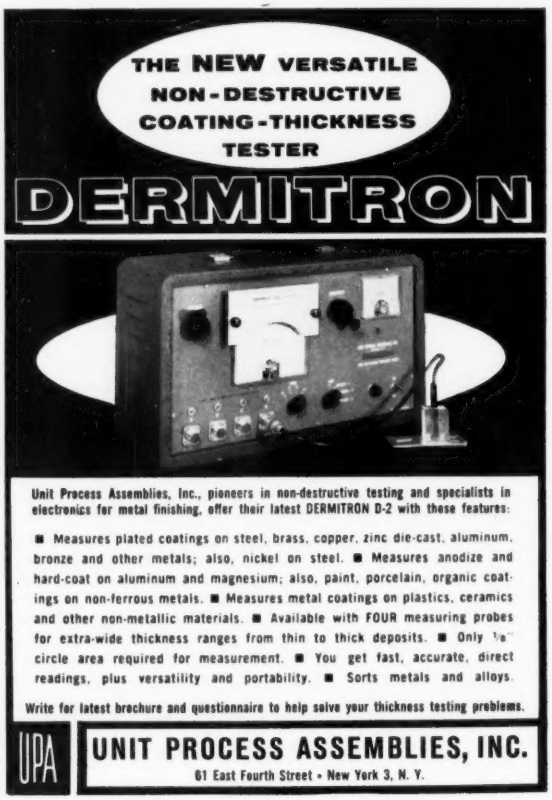
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Tumbling Barrels

Techline Div., Wheelabrator Corp., Dept. MF, 1179 Avenue V, Vicksburg, Mich.

A new bulletin, No. 452-D, on auxiliary tumbling barrels for wet blast equipment, contains complete operating instructions as well as mechanical and operating specifications.

Flexible Abrasive Head

Abrasive Machinery Corp., Dept. MF, 444 So. Pennsylvania St., Indianapolis 25, Ind.

New literature describes features of the Smooth-O-Matic contour sanding head for use on wood or metal.

Heat-Resisting Paint

Paint Sales Div., Joseph Dixon Crucible Co., Dept. MF, Jersey City 3, N.J.

Four-page, two-color brochure of technical data, V-89, contains instructive information concerning application data not ordinarily found in a sales circular. It includes a 1,000 degree temperature range reference chart of seven different heat resisting coatings and thumb-nail descriptions of each coating, reactive characteristics and guide details in applying.

In concise, understandable terms, the brochure outlines the conditions that cause difficulty with heat resisting coatings, suggests suitable types of coatings and gives the temperature ranges for these different coatings.

Airless Spray Coating

Nordson Corp., Dept. MF, Amherst, Ohio.

The above firm has available an illustrated brochure on its airless spray coating equipment. It answers such questions as what airless spray coating is, how it is accomplished, what pressures and temperature are required, what are the advantages, and how it functions.

Cleaning and Finishing Machinery

Cincinnati Cleaning & Finishing Machy. Co., Dept. MF, 2026 Hageman St., Cincinnati 41, Ohio.

A new bulletin offers quickly-read information in compact, 2-page form, on types of machines and systems, processes used in cleaning and finishing metal products.

News from California

By Fred A. Herr

Harvey Hunt, who started his sales engineering career with Hanson-Van Winkle-Munning at the home office in Matawan, N. J., some years ago, has returned to the H-VW-M fold. A graduate in chemical engineering at Rensselaer Polytechnic Institute, he left the organization to come to California ten years ago. His initial affiliation in California was with the sales staff of the L. H. Butcher Co. in Los Angeles. Subsequently, he joined the sales staff of Alert Supply Co. when that firm was organized in the early 1950's. In the fall of 1957 he went with the Los Angeles branch of L'Hommedieu & Sons Co. In November, 1958, Harvey returned to Alert Supply which, in the interim, had become a subsidiary of the Hanson-Van Winkle-Munning Co.

In mid-November Harvey had the pleasure of a reunion with another Rensselaer Polytechnic Institute alumnus in the person of *Kenneth Bellinger*, president of Corrosion Chem. Corp., Rockville, Conn. Mr. Bellinger was in Los Angeles to address Los Angeles Branch, A.E.S., on recent developments in chromating; and to confer with *Alford Perkins* and *A. D. Gaskin* of Alert Supply, who serve as West Coast distributor.

Ray T. Bayless, assistant secretary, American Society for Metals, announced in mid-December that at that time more than 85% of the display space for the Western Metal Exposition to be held in Los Angeles March 16 to 20, had already been assigned.

The Eleventh Western Metal Congress will be held on the same dates with the Ambassador Hotel in Los Angeles as the site for the meetings. Technical sessions will be held by the ASM, American Welding Society, Society for Non-Destructive Testing, and the Southern Sections of Metallurgical & Petroleum Engineers and the American Institute of Mining. Congress programs will be sparked by new developments in metallurgical processes achieved over the past two years.

Some two dozen representatives of Southern California metal processing, metal working, aircraft, electronics, and missile plants and laboratories attended a seminar in Maywood, Calif., that stressed discussion on brazing techniques.

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The one day (afternoon and evening) session was held in the offices of Metallurgical Consultants, Inc., in Maywood. On the speakers' panel were *Phillip G. Deuchler*, district sales manager for Handy & Harman; *Albert R. Pardoe*, senior research engineer, Missile Laboratories, North American Aviation; *Richard S. Preston*, staff member of Metallurgical Consultants; and *A. T. Cape*, consultant, Coast Metals, Inc.

Rohr Aircraft Co.'s plant in Chula Vista, Calif. has been equipped with eight 8,000-gallon aluminum etch and other tanks to supply corrosion resistant coatings on aluminum missile and aircraft components. The tanks measure 30 x 4½ by 9 feet.

William F. Davenport has been named metallurgical engineer for the Los Angeles district sales office of the Universal-Cyclops Steel Corp. He was formerly on the technical staff of the Chrysler Corp.

The annual educational session and dinner dance of Los Angeles Branch of the A.E.S. will be held at the Beverly-Hilton Hotel, Los Angeles, on March 21.

This event has been the social as well as technical highlight of the year for the Southern California plating industry for the past 28 years. *Lawrence Henderson*, general chairman, reports that a trio of outstanding speakers on currently significant subjects to metal finishing, have been contracted for. The speakers will appear on the technical program to be held from 9 a.m. to 1:30 p.m. *Emmett Babcock* is chairman of the technical program. The daytime activity will conclude with a luncheon following the close of the technical session.

The annual dinner dance will be held in the main ballroom of the Beverly-Hilton starting at 7:30 p.m. A floor show and a waltz contest are included in a diversified program of entertainment.

The plant of Chief Products Co., 701 East 59th Street, Los Angeles, was partially destroyed by fire on December 26 when flames originating in the furniture factory of the nearby Monarch Manufacturing Co. spread to it. Damage to two plants was estimated at $250,000. Chief operates a large plating division for finishing kitchen utensils.

A laboratory building has been completed by Dayton Foundry Co., Hollydale, Calif., in which have been consolidated various testing facilities previously conducted in individual departments in connection with chemical, physical and sand tests.

The Western Technical Writing Institute of Los Angeles has announced that a course in technical writing techniques will be offered from February 12 to April 16.

Consisting of 10 sessions, the course will cover instruction and practice in preparing technical papers, articles, reports, and manuals, as well as training in how to assemble and compile material, the psychology of writing production, rewriting, editing, and the major forms of technical writing.

Henry Duval, Institute director, announced that the course is designed to teach technically trained persons how to write effectively by employing the methods and techniques of the professional writer. Classes will be held every Thursday from 6:30 to 9:30 p.m., from February 12 to April 16, at Hotel Figueroa, Los Angeles.

Establishment has been announced of a revised method of distributing products of *The Glidden Co.'s* Chemicals-Pigments-Metals Division in the West Coast area. Effective January 1, 1959, the division channels all West Coast sales activities through its own offices at strategic locations there. The move has been effected in order to more adequately serve the division's steadily expanding number of customers in that area.

Ralph B. Quelos, eastern sales managers for the division, with headquarters in Baltimore, Md., will also manage sales for this important West Coast area. *William Ellis* will represent the division in the San Francisco vicinity, and *Fred Downer* and *M. Bonham* will be responsible for the Los Angeles area.

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Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Lancaster Branch

The regular meeting took place Dec. 12 at the Overbrook Country Club in Lancaster, Penna.

During the business meeting two new members were approved, *Patrick Johns* and *John Samos*.

The educational program consisted of a very fine talk from member *Wayne Streavig*, who described a bright brass plating solution which he developed.

I. Paul Sharretts
Sec'y.-Treas.

Chicago Branch

The Branch held its December meeting at the Western Society of Engineers on Friday, December 5.

Following the business meeting, *Jo-*

seph C. Corre, librarian, introduced the speaker of the evening, *William Geissman*, superintendent of metal finishing at National Lock Co., Rockford, Ill. The subject was a Report on Project 18—"The Mechanical Finishing of Metals." The technical information from the result of this study on the polishing and buffing of zinc base die-casting will be of tremendous interest to the polishing and buffing trade. A good number of questions followed which showed the keen interest of the audience in his talk.

Christopher Marzano
Publicity Chairman

British Columbia Branch

The December 15 meeting started at 6:30 P.M. at the Horseshoe Restaurant with forty-three members and guests. President *Jim Lee* opened the meeting with a welcome to the guests.

On the agenda was the "Electroplating Night School Course." President Lee asked for some expression of thought by the general membership as to planning for next year's course at a very advanced date. It was suggested by *Walter Kellerman*, instructor of the course, that a discussion of this topic should be postponed to the next general meeting.

Past President *Bill Marquardt* introduced *John Brandlmayr*, the guest speaker, who delivered an extremely interesting talk, illustrated by color transparencies of action shots, and explained some of the design features and construction of boats. A question and answer period followed.

N. A. Shepherd,
Secretary

Grand Rapids Branch

December 12 marked the second annual joint meeting of the Grand Rapids Branch with the Western Michigan Chapter of the Society of Die Casting Engineers. Despite bad weather, 79 members of both societies met and enjoyed cocktails, roast sirloin of beef dinner, and interesting conversation about the many common problems of both die casting and electroplating.

The two new members elected to the society at the December meeting were *Donald O. Hubbard*, general foreman at Grand Rapids Brass and *Thomas F. Rademacher*, sales staff of Haviland Products.

The main speaker for the evening was *William H. Safranek*, assistant chief of the Electrochemical Engineering Division at Battelle Memorial Institute, whose subject was "Improved Electroplated Finishes for Zinc Based Die Castings." Mr. Safranek's talk was followed by an enthusiastic question period. Some interesting comments and opinions resulted.

Thomas C. Henner
Second Vice President

Newark Branch

The December meeting was held on the 12th with fifty-five present. One application was received and *George Bartley* of American Aluminum Co., *Herbert Brown* of National Electric Products, *James Conolly* of Hanson-Van Winkle-Munning Co. and *Walter Miller* of Frequency Standards were elected to membership. The transfer of *Morris Tardiff*, H-VW-M, from Grand Rapids to Newark was approved.

Fred Meyer, Christmas Party chairman, reported all set for Saturday night and urged a good turn-out. *George Reuter* stated that the Branch history was in the final stages as the result of a meeting that evening attended by *Sam Taylor*, *Ed Faint* and *Don Foulke*.

Librarian *Al Korbelak* then introduced *Eugene Wagner* who discussed "Lead Plating." He pointed out the purpose of lead deposits, the solution composition, conditions and explained how the bath must be maintained. Lead-indium and silver-lead bearings were described and stripping methods given.

W. H. Walczyk of Remington Rand Division of Sperry Rand Corp. then presented a paper on "Printed Circuits." He discussed design for printed circuits and the various methods of preparing circuits and pointed out the trend towards plating through the holes. The increased use of electroless nickel and copper was noted as was the improved cleaners now available. Many questions were asked, attesting to the interest in the subject, and it was agreed the programi was a good one.

D. Gardner Foulke

Los Angeles Branch

A talk on "Recent Developments in Chromating" by *Kenneth Bellinger*, president, Conversion Chemical Corp., Rockville, Conn., was the high spot on the educational program of the December 10 meeting of the branch.

Branch president *Norman McEwan* presided over the business session from 7 to 8 p.m. An attendance of 80 members and guests was reported by Sergeant-at-arms *W. C. Heinecke*. Membership chairman *George Hetz* announced that the "boom was about to be lowered" on a score or more of delinquent members who have not responded to mail and personal suggestions for paying their dues.

Don Bedwell, now retired after 30 years of activity as plant foreman for the Hall-Mak Co., paid a tribute to the late *Herold J. Kroesche*, Southern California representative for the Harshaw Chemical Co., who passed away of lung cancer on December 8. Bedwell reviewed Herold's long career as a tech-

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nical engineer in the plating field and his many services to the A.E.S., with which group he had held membership for more than 25 years.

Since the family had requested that no floral tributes be sent, Bedwell moved that members present at the meeting contribute to a fund which would be presented to the American Cancer Society. A susbtantial sum was raised among the 80 members and guests, and the branch supplemented it by adding the amount that ordinarily would have been allocated for a floral wreath.

Los Angeles Branch's annual educational session and dinner dance is scheduled to be held at the Beverly Hilton Hotel, Los Angeles, on March 21. With *Larry Henderson*, a man of vision and originality, as general chairman, the 1959 affair promises to be well arranged, technically and socially. Henderson announced that much of the preliminary programming had already gotten underway in December, and that his various committees would meet weekly in January, February and early March to complete the details for a technical program, including three outstanding speakers, a noon-day luncheon, and a dinner dance and entertainment program in the evening, part of which will again be a waltz contest.

St. Louis Branch

President *William George*, who is employed by National Rejectors Co., and Librarian *Arthur Wrisberg*, arranged for the Branch to tour the National Rejectors Co. plant on Dec. 10. A group of about 50 members and guests gathered at the plant about 7:30 and were taken with a guide through the plant. The group was able to observe full automatic cadmium and nickel-chromium plating equipment; barrel plating; tumble deburring; and also a conveyorized washing, phosphating and painting installation.

After the tour a buffet lunch was served courtesy of the company. We want to thank *Raymond Gottfried* and *William Gailey* of the company for their cooperation in making this plant visitation possible.

Ward Kelly
Secretary

Blue Ridge Branch

Blue Ridge Branch held its regular monthly meeting on December 5, at the Hut Restaurant, Route 220, Martinsville, Va.; *T. R. Boggess* presiding. Several of the members brought examples of their plating and special techniques to exhibit at the meeting. These exhibits included a gold-silver-rhodium plated (on plastic) chess set; bronze plated baby shoes; brass on nickel tubular furniture legs; nickel, rhodium, and solder plated printed circuits; aluminum plating on steel and copper, and a silver plated, block tin cream pitcher.

The speaker of the evening was *Robert Gore* of Metal and Thermit Corp., who spoke on the subject of alloy plating.

B. F. Murphy
Acting Sec.

Buffalo Branch

The usual business and technical meeting was replaced in December with the annual Christmas Party held Saturday, December 20, at the Niagara Manor. A good time was had by all, thanks to the fine work of the committee headed by *Roger Brown*, and ably assisted by *Robert Eich* and *Roy Laciura*.

The program for the 5th Empire State Regional Meeting to be held in Buffalo, April 11, 1959, at the Hotel Stuyvesant is near completion.

The March business and technical meeting will be held Friday, March 6th, at the regular meeting place.

Robert E. Lienert
Secretary

Waterbury Branch

The December meeting was held at the Roger Smith-Elton Hotel on Thursday, December 11. It was announced that the branch had added its twentieth sustaining member with the signing up of Wallace Silversmiths Inc. *Ray Mitchell* has done an outstanding job in securing additional sustaining members.

Announcement was made that the Branch Social Evening would be held on Valentine's Day, Feb. 14, at the

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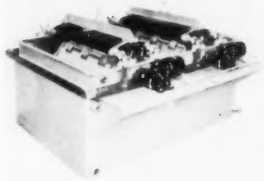

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Chase Country Club. This is a departure from the usual Christmas Party, in order to take some of the strain off the Christmas Social Calendar.

Nick Topazio of the Patent Button Co. introduced the speaker of the evening, *Perry Sloane*, whose subject was "Precious Metal Plating." He gave an excellent paper on the subject and dealt with many aspects of precious metal plating related to the aircraft, missile, and electronic industries. He had some choice remarks about plating specifications particularly from the platers' point of view.

F. A. Schneiders
Publicity

Dayton Branch

The thirteenth annual Educational Session and Dinner Dance will be held on Saturday, March 7, 1959 at the Hotel Biltmore in Dayton. The committee chairmen are: General Chairman, *Bennie Cohen;* Co-Chairman, *Byron Bowman;* Hotel Arrangements, *James Shane;* Educational Sessions, *Laurence Hadlock;* Tickets and Treasurer, *Richard Wright;* Secretary and Publicity, *Richard Clinehens;* Entertainment, *Robert Rudeff;* Favors, *Duane Prosser;* Program and Advertising, *Robert Fisher.*

John P. Nichols, executive secretary of the AES, is the honorary chairman for the educational session, to start at 1:30 p.m. Speakers and topics are: *Dr. F. A. Lowenheim*, Metal and Thermit Corp., "Corrosion of Plated Finishes"; *Ezra A. Blount*, Editor, Products Finishing, "Factors Affecting Job Plating Costs"; and *Wm. K. Murray*, Enthone, Inc., "Stripping of Organic Coating."

The dinner and dance will start at 6:30 P.M.

Columbus Branch

The regular monthly meeting of the branch was held at Reebs Restaurant on Friday, December 5, at 6:00 P.M. The business meeting was called to order by Vice President *Marvin Pingel. Max Morelock* was duly approved and elected as a member of the branch.

Rudy Skriletz gave a report on the Tri State meeting he attended November 8, 1958 at Louisville, Ky. He is awaiting a report on a bylaw revision about finances and will present it to the branch for their comment at a later date.

Librarian *Les McGraw* introduced the speaker of the evening, *Alfred M. Weisberg* of Technic, Inc., whose subject was "Electroplating of Precious Metals." Mr. Weisberg gave a very interesting talk on precious metal plating.

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

Halvor Christianson

New York Branch

First vice-president *Joseph Rembecki* called the Dec. 12 meeting to order at 8:30 P.M. in the absence of *Dr. Ed.*

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Saubestre. One new member, *Andrew Nosty*, of Continental Connector Corp., was elected and welcomed into the society.

Mr. Rembecki, as banquet chairman, reported that the affair to be held on February 7, 1959, will be a milestone in the fifty-year history of the New York Branch. Preceding the banquet there will be a gala cocktail party in the Statler's Penntop North, which will be sponsored jointly by the suppliers. The dinner will feature steak and imported wines. Tickets are priced at $12.50 per person.

This latter announcement prompted *J. A. Stremel* to reminisce about how he and Mr. Hogaboom ran the first N. Y. Branch Banquet at $1.00 per ticket — and made a profit on the affair.

Librarian *Arthur Carlson* introduced the panel of experts, Messrs. *I. Friedman*, *A. Fusco* and *C. Weiner*, who presided over a rough-and-tumble question and answer session. Needless to say, it seemed that the experts had most of the problems, which the members tried to answer as best they could.

To top off the evening, the Branch provided a sumptuous feast of fried shrimp, hors d'oevres, cheese and crackers, coffee and Danish pastry, and beer. It was a most successful meeting to close the year's activities.

Martin Pollack
Acting Recording Sec.

AMERICAN SOCIETY FOR ABRASIVES

The Detroit Chapter held its first annual dinner meeting on Thursday evening, December 4, 1958. Approximately 230 members and guests were present to see *Cal E. Edwards*, president of the chapter, turn over the reins of office to *Emil Vogeley*, president-elect for the 1959 term.

Lee K. Pruett, national director, officiated in the ceremony, and charged Mr. Vogeley and his elected group of officers with upholding their accepted responsibiilties and the bylaws of the society, and administered the oath of office.

A presentation of an engraved watch was then made to Mr. Edwards in appreciation for his contributions to the chapter.

The festivities were enlivened by the presence of *Jack Kennedy*, coffee speaker, a lovely young lady singer, accompanied by an accordionist, who led group singing, and a prestidigitator with his amazing tricks. Included was a smorgasbord dinner which consisted of country salad, entrees, a variety of cold cuts, fried chicken, roast beef and desserts. The membership took care of the "Spirits of Jubilation." The drawing of many door prizes concluded the festivities.

THE ELECTROCHEMICAL SOCIETY

Research in the field of corrosion inhibitors will be discussed at a meeting to be held in Chicago on May 7 under sponsorship of Armour Research Foundation of Illinois Institute of Technology and the Chicago section of the Society.

The meeting — titled Symposuim on Corrosion Inhibitors — will be devoted to consideration of basic studies concerned with the theory and mechanism of inhibitory processes. *Jacob Miller* and *Ernest L. Koehler* are the symposium chairmen.

Inquiries concerning the meeting should be sent to *M. J. Jans*, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

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200	65	G. E.
200	7½	Hobart
300	7½	Hobart
400	60/60	G. E.
400	6	H-V-W
500	60	Westinghouse
750 (Twin)	6	H-V-W
750/375	6/12	Excell-All
940	32	Elec. Prod.
1000/500	6/12	Chandeysson
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1500	30/50	Century
1500	40/65	G. E.
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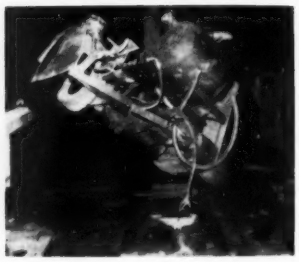

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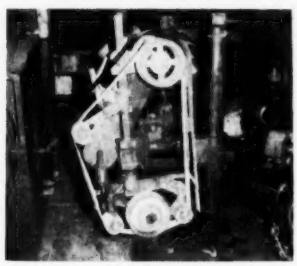

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1—1500 Ampere Columbia Anodizing Motor-Generator Set, 0 to 50 volts, type XRE Generator, direct coupled to 100 HP, 600 RPM Synchronous motor, with outboard exciter. Input is 3/60 and set is mounted on steel base. Equipped with Timken Roller Bearings.

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Weehawken, N. J. — P. O. Box 689 — UNion 4-1010
Reading, Pa. — Box 756 — FRanklin 5-8474
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Two drum type washers, 3-stage, with dry-off, steam heated. Machines purchased new in 1952 — used approximately 2 years — practically new.

One single stage drum type washer with dry-off. Machine new in 1954 — used 1 year — practically new.

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EXECUTIVE SALES AND SERVICE — SOUTHEAST

SITUATION OPEN—Leading manufacturer of precious metals plating processes and equipment must expand southeast representation due to growth of business in this area. Successful applicant will have technical education or equivalent background in electro-chemistry or chemical engineering, with a comprehensive knowledge of electroplating practices. This is a career opportunity with the acknowledged pioneer in the industry. Eventual income limited only by ability to produce. Area residents only, air mail complete resume, including past earnings. Interviews in your area starting during Dixie Regional AES Meeting February 13 and 14 in Atlanta. Sel-Rex Corporation, 75 River Road, Nutley 10, New Jersey, Attention: Mr. S. S. Wilson.

GRADUATE CHEMIST

SITUATION OPEN — For research and development on metal finishing compounds, cleaners, conversion coatings, etc. Pleasant working conditions in laboratory of well-established leader in this field. Location, N.Y.C. area. Prefer man of about 30 years with five years plating experience. Address: February 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

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CIRCO EQUIPMENT CO.
51 Terminal Ave. — Clark, N. J.

REPRESENTATIVES

To sell unusually complete line of proven Barrel Finishing Equipment, Compounds and Abrasives manufactured by specialists with years of practical experience. Field expanding rapidly. Repeat business builds steady income. Some excellent territories available. Send details on experience, lines handled, territory covered and references.

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TECHNICAL DIRECTOR

SITUATION OPEN—Medium size shop, vicinity New York City. Burnishing, copper barrel plating, nickel barrel plating and gold barrel plating of small parts. To be in complete charge of time study, work flow analysis, quality control and price estimates. Salary $9,000 to start. Advancement to assistant general manager and eventually to general manager. Address: August 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATION OPEN — Experienced in electroplating and metal finishing processes. Responsible for manufacturing processes, solution control. Prefer experience in plating plant operation and/or experience in wire finishing. State salary requirements and qualifications.

CONTAINER STAPLING CORPORATION
P. O. Box 247 — Herrin, Ill.

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POLISHING AND PLATING EXECUTIVE

SITUATION WANTED — Twenty-one years actively engaged, diversified experience with precious and non-precious metals. Administrative ability. Plant manager. Address: February 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

TECHNICAL SALES

SITUATION WANTED—I can offer you over 25 years experience in the metal finishing field. Thoroughly experienced in all phases of barrel plating, rack plating in all finishes, anodizing, polishing and buffing in both job shop and production plant operation. Interested in technical sales, or will act as manufacturers' agent, New England area. Address: January 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROPLATING ENGINEER

SITUATION WANTED — Graduate engineer, 20 years industrial, laboratory and development experience in almost all phases of metal finishing including precious metals, corrosion. Cost conscious planning, control of processes, trouble shooting, equipment design. Adequate position wanted in metropolitan New York area. Address: January 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

Abbey Process Automation, Inc. 40
37-01 48th Ave., Long Island City 1, N. Y.
Acme Manufacturing Co. 96
1400 E. 9 Mile Rd., Detroit 20 (Ferndale), Mich.
Agate Lacquer Mfg. Co., Inc. 103
11-13 43rd Rd., Long Island City 1, N. Y.
Alchemize Corp.
Congress Expressway & S. Kolmar Ave., Chicago 24, Ill.
Alert Supply Co.
2041 S. Davie Ave., Los Angeles, Calif.
Allied Research Products, Inc. 27
4004 E. Monument St., Baltimore 5, Md.
Alsop Engineering Corp. 105
1402 Bright St., Milldale, Conn.
American Brass Co.
Waterbury 20, Conn.
American Buff Co. 31
2414 S. LaSalle St., Chicago 16, Ill.
Ampco Metal, Inc.
1945 So. 38th St., Milwaukee 46, Wis.
Apothecaries Hall Co., Div. of The Hubbard-Hall Chemical Co.
22 Benedict St., Waterbury 20, Conn.
Armitage & Co., John L. 92
245 Thomas St., Newark 5, N. J.
Bacon Felt Co. 26
437 W. Water St., Taunton, Mass.
Baker Bros., Inc. 118
564 E. First St., So. Boston 27, Mass.
Baker Co., Alan 116
180 Sylvester Rd., South San Francisco, Calif.
Baker Co., The M. E. 115
25 Wheeler St., Cambridge 38, Mass.
Barker Bros., Inc. 111
1660 Summerfield St., Brooklyn 27, N. Y.
Beam-Knodel Co. 109
195 Lafayette St., New York 12, N. Y.
Beck Equipment Co. 104
3350 W. 137th St., Cleveland 11, Ohio
Belke Manufacturing Co. 16
947 N. Cicero Ave., Chicago 51, Ill.
Better Finishes & Coatings, Inc. 89
268 Doremus Ave., Newark 5, N. J.
Blakeslee & Co., G. S.
1844 S. Laramie Ave., Chicago 50, Ill.
Brucar Equipment & Supply Co. 118
602-604 20th St., Brooklyn, N. Y.
Buckingham Products Co. 88
14100 Fullerton Ave., Detroit 27, Mich.
By-Buk Co.
4314 W. Pico Blvd., Los Angeles 19, Calif.
Chandeysson Electric Co. 17
4074 Bingham Ave., St. Louis 16, Mo.
Chem-Solts, Inc. 112
P.O. Box 2803 Sta. D, Atlanta 18, Ga.
Chemical Corp., The 113
58 Waltham Ave., Springfield 9, Mass.
Churchill Co., Inc., Geo. R.
Hingham, Mass.
Ciba Co., Inc.
627 Greenwich St., New York 14, N. Y.
Cincinnati Cleaning & Finishing Machinery Co.
2027 Hageman St., Cincinnati 41, Ohio
Circo Equipment Co. 93
51 Terminal Ave., Clark Twp. (Rahway), N. J.
Clair Manufacturing Co., Inc. 104
Olean, N. Y.
Cleveland Process Co. 86
1965 E. 57th St., Cleveland 3, Ohio
Clinton Supply Co. 116
112 S. Clinton St., Chicago 6, Ill.
Cohn Mfg. Co., Inc., Sigmund 26
121 S. Columbus Ave., Mt. Vernon, N. Y.
Columbia-Southern Chemical Corp. 28
One Gateway Center, Pittsburgh 22, Pa.
Crown Rheostat & Supply Co. 6
1965 Pratt Blvd., Elk Grove Village, Ill.
Davies Supply & Mfg. Co. 102
4160 Meramec St., St. Louis 16, Mo.
Davis-K Products Co.
135 W. 29th St., New York 1, N. Y.
Dawe's Laboratories, Inc. 106
4800 S. Richmond St., Chicago 32, Ill.
Dean Thermo-Panel Coil Div., Dean Products, Inc. 114
613 Franklin Ave., Brooklyn 38, N. Y.
Deering, Milliken & Co., Inc.
1045 Sixth Ave., New York 18, N. Y.
Detrex Chemical Industries, Inc.
Box 501, Detroit 32, Mich.
DeVilbiss Co., The 18, 19
Toledo 1, Ohio
Dixon & Rippel, Inc. 109
Box 116, Saugerties, N. Y.
Dow Chemical Co., The 9, 10, 11, 12
Midland, Mich.
Du Pont de Nemours & Co., E. I. 32, 33
Wilmington 98, Del.
Egyptian Lacquer Mfg. Co.
Box 444, Newark 1, N. J.
Electro-Glo Co. 107
621 S. Kolmar Ave., Chicago 24, Ill.
Engelhard Industries, Inc., Chemical Div.
113 Astor St., Newark 2, N. J.
Enthone, Inc. 3
442 Elm St., New Haven 11, Conn.
Federated Metals Div., American Smelting & Refining Co.
120 Broadway, New York 5, N. Y.
Formax Mfg. Corp. 102
3171 Bellevue, Detroit 7, Mich.
Frank, Paul 113
118 E. 28th St., New York 16, N. Y.
G. S. Equipment Co. 8
15583 Brookpark Rd., Cleveland 35, Ohio
Graver Water Conditioning Co.
216 W. 14th St., New York 11, N. Y.
Grav-i-Flo Corp. 94
400 Norwood Ave., Sturgis, Mich.
Grieve-Hendry Co., Inc. 108
1421 W. Carroll Ave., Chicago 7, Ill.
Gumm Chemical Co., Inc., Frederick Inside Front Cover
538-542 Forest St., Kearny, N. J.
Hamilton Emery & Corundum Co. 114
Chester, Mass.
Hammond Machinery Builders, Inc. 87
1601 Douglas Ave., Kalamazoo 54, Mich.
Hammond Solvents Recovery Service
241 Brunswick St., Hammond, Ind.
Handy & Harman
82 Fulton St., New York 38, N. Y.
Hanson-Van Winkle-Munning Co. 46
Matawan, N. J.
Hardwood Line Mfg. Co. 112
2022 N. California Ave., Chicago 47, Ill.
Harrison & Co., Inc. 105
487 Groveland St., Haverhill, Mass.
Harshaw Chemical Co., The 20
1945 E. 97th St., Cleveland 6, Ohio
Heetbath Corp. 34
Springfield 1, Mass.
Heil Process Equipment Corp. 34
12901 Elmwood Ave., Cleveland 11, Ohio
Holland & Sons, Inc., J. 115
485 Keap St., Brooklyn 11, N. Y.
Hooker Chemical Corp. 25
1302 Union St., Niagara Falls, N. Y.
Hull & Co., Inc., R. O. 38
1301 Parsons Ct., Rocky River 16, Ohio
Ideal Chemical Co. 117
1499 Dean Dr., So. Euclid 21, Ohio
Illinois Water Treatment Co. 91
840 Cedar St., Rockford, Ill.
Industrial Filter & Pump Mfg. Co. 14
5906 Ogden Ave., Chicago 50, Ill.
Industrial Instruments, Inc.
89 Commerce Rd., Cedar Grove, N. J.
Infilco, Inc. 22
P.O. Box 5033, Tucson, Ariz.
International Rectifier Corp.
1521 E. Grand Ave., El Segundo, Calif.
Ionic Electrostatic Corp. 43
105-119 Monroe St., Garfield, N. J.
Jelco Finishing Equipment Corp. 97
153 E. 26th St., New York 10, N. Y.
Kocour Company 42
4802 S. St. Louis Ave., Chicago 32, Ill.
Kosmos Electro-Finishing Research, Inc.
140 Liberty St., Hackensack, N. J.
Kushner, Dr. Joseph B. 114
2509 Washington Ave., Evansville, Ind.
Land, Inc., L. J. 119
P. O. Box 689, Weehawken, N. J.
Lasalco, Inc. 21
2820-38 Lasalle St., St. Louis 4, Mo.
Lea Mfg. Co. 35
16 Cherry Ave., Waterbury 20, Conn.
Lea Michigan, Inc.
14066 Stansbury Ave., Detroit 27, Mich.
Lea-Ronal, Inc. 36
139-20 109th Ave., Jamaica 35, N. Y.
L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago 23, Ill.
Lindale Equipment & Supply Corp. 115
504 Smith St., Brooklyn 31, N. Y.
Losey Co., Arthur H.
110 S. Horton St., Jackson, Mich.
Lowe Brothers Co., The 23
Dayton 2, Ohio
Macarr, Inc.
2543 Boston Rd., Bronx 67, N. Y.
MacDermid, Inc. Back Cover
Waterbury 20, Conn.
Manhattan Rubber Div., Raybestos-Manhattan, Inc. 95
6 Willett St., Passaic, N. J.
Meaker Company, The
1633 S. 55th Ave., Chicago 50, Ill.
Metal Finish., Inc. 29
408 Frelinghuysen Ave., Newark, N. J.
Metal & Thermit Corp. 15
Rahway, N. J.
Michigan Chrome & Chemical Co.
8615 Grinnell Ave., Detroit 13, Mich.
Motor Repair & Mfg. Co., The 117
1555 Hamilton Ave., Cleveland 14, Ohio
Murray-Way Corp.
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
National Polymer Products, Inc.
Reading, Pa.
Nazar Rubber Co., The
2727 Avondale, Toledo 7, Ohio
New Holland Machine Co. 106
New Holland, Pa.
Nordson Corp.
Jackson St., Amherst, Ohio
Northwest Chemical Co. 44
9310 Roselawn Ave., Detroit 4, Mich.
Norton Co.
1 New Bond St., Worcester 6, Mass.
Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.
Octagon Process, Inc. 114
15 Bank St., Staten Island 1, N. Y.
Packer Machine Co.
456 Center St., Meriden, Conn.
Park Chemical Co.
8074 Military Ave., Detroit 4, Mich.
Pennsalt Chemicals Corp.
3 Penn Center Plaza, Philadelphia 2, Pa.
Pesco Plating Equipment Corp. 116
75 Wythe Ave., Brooklyn 11, N. Y.
Pfizer & Co., Inc., Chas.
630 Flushing Ave., Brooklyn 6, N. Y.
Phelps Dodge Refining Corp. 90
300 Park Ave., New York 22, N. Y.
Plating Products, Inc. 98, 99
1509 N. Washington, Kokomo, Ind.
Plating Service & Equipment Corp. 116, 118
3620 Hart St., Detroit 14, Mich.
Potter Paint Co., Inc. 42
21 Crawford St., Cortland, N. Y.
Quartz Radiation Corp.
54 Summer Ave., Newark, N. J.
Ramco Equipment Corp.
807 Edgewater Rd., New York 59, N. Y.
Randolph Products Co.
92 N. 12th St., Carlstadt, N. J.
Rapid Electric Co.
2881 Middletown Rd., Bronx 61, N. Y.
Raybestos-Manhattan, Inc. Manhattan Rubber Div. 95
Passaic, N. J.
Robertshaw Fulton Controls Co., Fulton Sylphon Div.
Knoxville 1, Tenn.
Rona Laboratories, Inc.
E. 21st & E. 22nd Sts., Bayonne 3, N. J.
Sandoz, Inc.
61 Van Dam St., New York 13, N. Y.
Saran Lined Pipe Co.
2415 Burdette Ave., Ferndale 20, Mich.
Schaffner Mfg. Co., Inc. 110
22 Herron Ave., Emsworth, Pittsburgh 2, Pa.
Schori Process Corp.
8-11 43rd Rd., Long Island City 1, N. Y.
Sel-Rex Corp. 85, Inside Back Cover
75 River Rd., Nutley 10, N. J.
Service Screw Products Co. 113
131 N. Green St., Chicago 7, Ill.
Sethco Mfg. Co. 101
2280 Babylon Turnpike, Merrick, L. I., N. Y.
Siefen Co., J. J. 100
5643 Lauderdale, Detroit 9, Mich.
Solvay Process Div., Allied Chemical Corp. 41
61 Broadway, New York 6, N. Y.
Solvents Recovery Service 112
1025 Broad St., Newark 2, N. J.
Sommers Bros. Mfg. Co. 114
3439 No. Broadway, St. Louis 7, Mo.
Stevens, Inc., Frederic B. 37
1808 - 18th St., Detroit 16, Mich.
Stokes Corp., F. J.
5500 Tabor Rd., Philadelphia 20, Pa.
Storts Welding Co., Inc. 107
38 Stone St., Meriden, Conn.
Stutz Co., The 39
4430 W. Carroll Ave., Chicago 24, Ill.
Surety Rubber Co. 100
Carrollton, Ohio
Technic, Inc. 45
39 Snow St., Providence, R. I.
True Brite Chemical Products Co. 101
P. O. Box 31, Oakville, Conn.
Udylite Corp., The 13, 24
Detroit 11, Mich.
Unit Process Assemblies, Inc. 108
61 East 4th St., New York 3, N. Y.
U. S. Galvanizing & Plating Equipment Corp.
31 Heyward St., Brooklyn 11, N. Y.
U. S. Stoneware
Akron 9, Ohio
Univertical Foundry & Machine Co. 103
14841 Meyers Rd., Detroit 27, Mich.
Victor Chemical Works
155 No. Wacker Dr., Chicago 6, Ill.
Worthy Products Co. 118
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Wyandotte, Mich.
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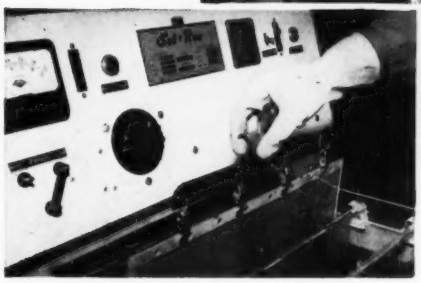

IBM Plating operator removes printed wiring board from Sel-Rex Jet Plater where it has been plated with Sel-Rex Bright Gold. The Jet Platers assure optimum conditions for the electrodeposition of Sel-Rex Bright Gold for this exacting application.

Heart of the SAGE System is the 275 ton IBM computer, one of the world's largest and most reliable. Shown here are some of the computer frames containing pluggable electronic units that perform the data processing involved in solving air defense problems.

SEL-REX BRIGHT GOLD AND 4 JET PLATERS HELP PROVIDE "BUILT-IN" RELIABILITY TO IBM SAGE COMPUTER

When it comes to protecting our country from possible surprise air-attack, only the best, most reliable instruments and equipment will do. Understandably, IBM was chosen to build the 275 ton computer pictured in part at the lower left, which is the heart of our SAGE System. The SAGE computer performs millions of computations at lightning speed, and continuously checks them—*automatically.*

Approximately 7,300 pluggable units containing printed card assemblies are used in this computer. Needless to state, the proper functioning of these units is essential. Sel-Rex Bright Gold, in four Jet Platers, is used in the manufacture of the IBM SAGE computer, and other military equipment under development. Built-in reliability—for which IBM equipment is famous the world over—assures us all of constant electronic watchfulness 24 hours a day.

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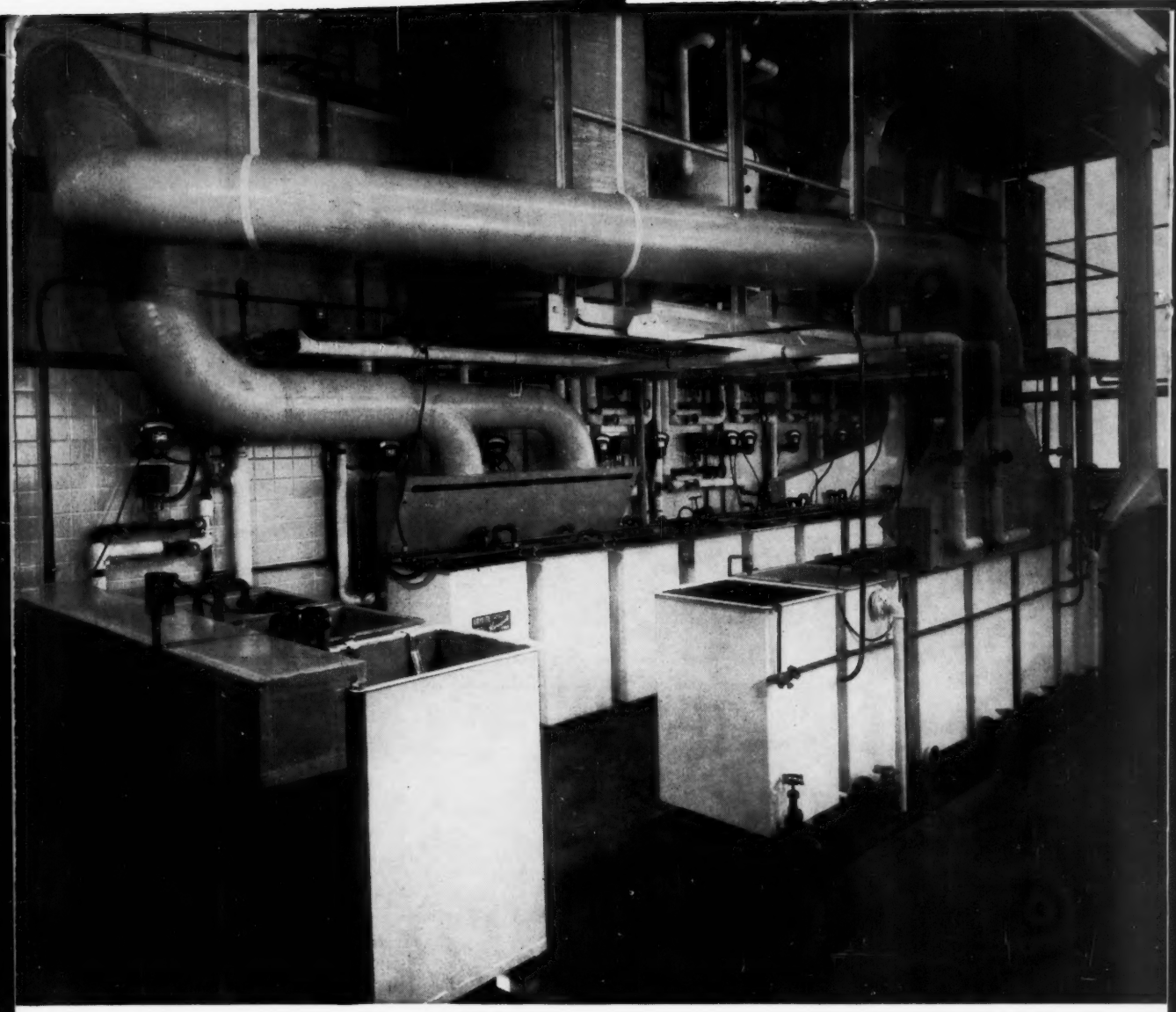

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